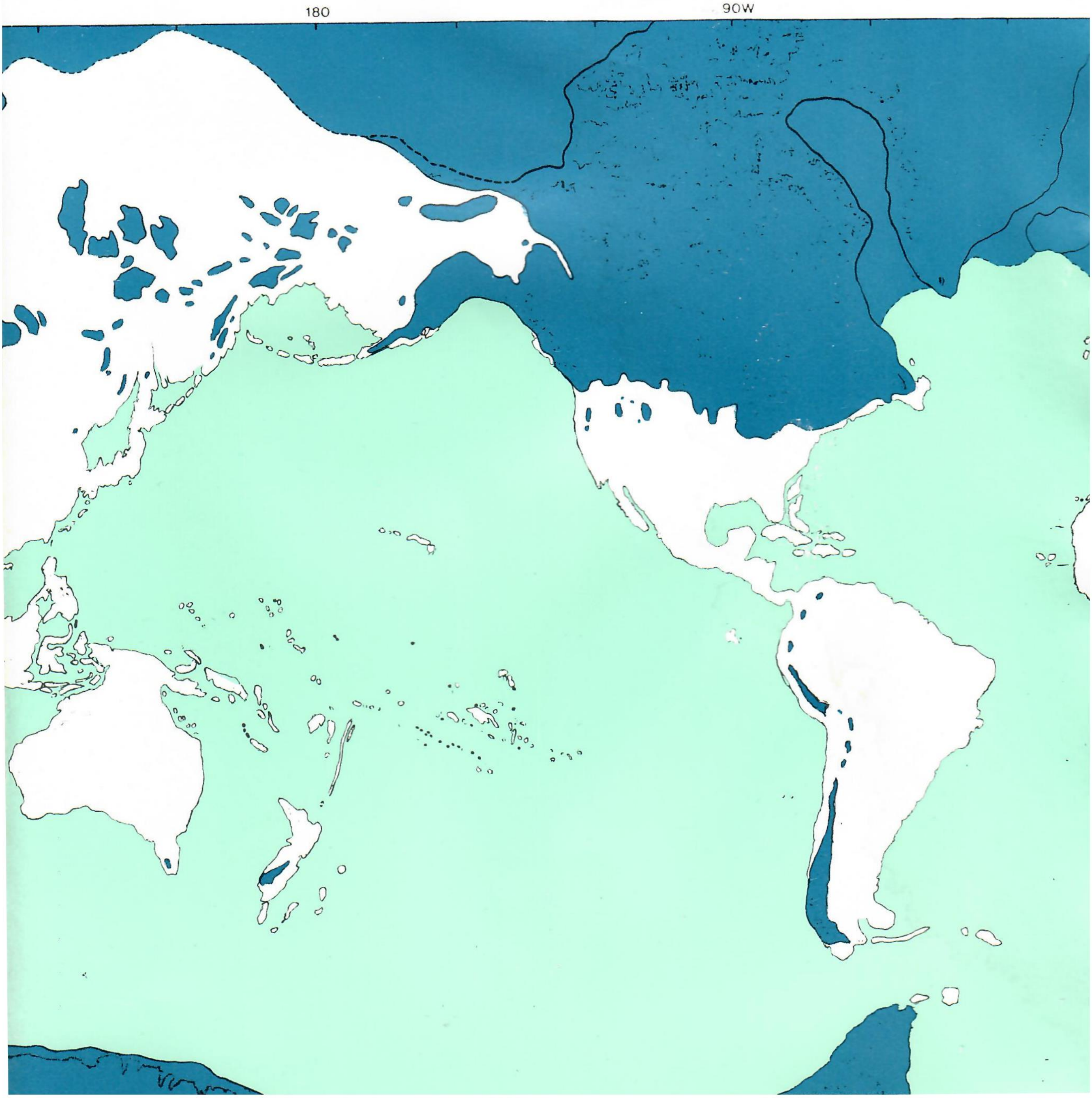
PREHISTORIC MONGOLOID DISPERSALS

No. 7

Special Issue 1990



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Introduction

This special issue of *Prehistoric Mongoloid Dispersals* collects four papers presented for a project currently underway in Japan on Prehistoric Mongoloid Dispersals, funded by the Japanese Ministry of Education, Science and Culture. The project undertakes to study the evolution and dispersal of modern humans within the East Asian region, and the continuation of these processes on the American continents and in the Pacific.

The four-year Project, which began in 1989 and will last till 1992, involves, at present, the cooperation of 43 institutions — universities, museums, research institutes — with a total of 85 participating specialists in a wide range of disciplines: archaeology, ethnology, physical anthropology, human genetics, geomorphology, isotope sciences, and computer sciences.

While the Project involves only scholars and institutions within Japan, the organizers have been keenly aware that research in prehistoric dispersals to the Americas, the "Peopling of the New World," is very advanced in the United States and Canada. It is for this reason that very early in the Project, and even in its preliminary stages, scholars from both these countries were invited to Japan to address Project researchers and share with them the most recent advances in prehistoric research.

The papers in this issue were presented at symposia within the Project. The first, by C. Melvin Aikens, was presented at a symposium on the Dispersal of East Asian Peoples during the Upper Pleistocene, held at the University of Tokyo Museum in 1987. The three other papers, by Charles E. Schweger, W.R. Powers, and Merritt Ruhlen, were given at a symposium on the Prehistoric Mongoloid Dispersals held at Hokkaido University in 1989.

Human evolution has been a continuous cycle of dispersals and migrations. Over millions of years of migrating and dispersing, groups branched off, some moving on while others settled, developing their subsistance economies and their cultures as they did. The existence of many different cultures in the world today is witness to this history of human migration. Of the many dispersal patterns taken by our early ancestors, those taken by prehistoric East Asians, or Mongoloids, represent the largest in scale. Starting their journey from East Asia, they were the first humans to successfully adapt to the Arctic zone, crossing the Bering land bridge, and dispersing and settling in various parts of the American continents with groups finally reaching the southern tip of South America. Other groups chose to migrate to the islands of the Pacific Ocean, and from their far-flung settlements we see today a wide range of cultural patterns.

The study of prehistoric movements of Mongoloids has been the subject of only isolated studies in the past, and it is the aim of this Project to bring together as many disciplines as possible to be able to draw a comprehensive picture of human migration to the Americas and the Pacific. The topic is one that is so grand in scale — in both the expanse of land covered and time elapsed — that it cannot be conveniently categorized under a framework of area studies. With the participation of our colleagues from abroad and multidisciplinary Project teams we have been inspired to further pursue our research.

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Takeru Akazawa
The University Museum
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October 19, 1990

From Asia to America:
The First Peopling of the New World

C. Melvin Aikens

A major issue for research into the prehistoric dispersal of Asiatic Mongoloid peoples is the question of the first Americans. No authority doubts that the ancestral American Indians came from Northeast Asia across the Bering land bridge, but when they came, and with what cultural baggage, is not yet fully resolved. This essay reviews the problem from an intercontinental perspective and suggests that the cultural adaptation to high, cold latitudes that was first achieved by humans during terminal Pleistocene times led to their northward expansion throughout Eurasia and brought the first Americans across Beringia into the western hemisphere between about 18,000 and 14,000 years ago.

1 The Demonstration of Human Antiquity in Europe, and the Question of Human Antiquity in the New World

From the 17th century until well into the 19th, European scholars tended to accept literally the conclusion, based on careful study of the days and years enumerated in the Christian Bible, that the earth and humanity were only about 6000 years old. By the 1860's, however, European geologists and prehistorians had shown that human artifacts, found associated in the gravels of ancient river terraces with the bones of elephants and other ice age creatures, greatly antedated the biblical chronology (Grayson 1983; Meltzer 1983).

American scientists sought to examine their own evidence from the same point of view. Crudely flaked stone specimens from the eastern United States were compared to ancient artifacts from Europe, and influential scholars inferred from some of the observed typological similarities that there was indeed a New World Paleolithic comparable to that of the Old World. Subsequently, the continuing failure of investigators to find really convincing geological and faunal evidence for human antiquity in America reversed this opinion. This ushered in a period (ca 1890–1930) of debate and strong assertions of a very recent date for the appearance of people in America. After excavations in 1926, 1927, and 1928 showed clear-cut associations between distinctive well-flaked stone spear points and the skeletons of now-extinct *Bison antiquus* at Folsom, New Mexico, it was generally recognized that people had been in America since the end of the last glacial age (Meltzer 1983).

2 Old World Paleolithic Antecedents

Today, the effort to determine when people initially entered the Americas still goes on. Because some archaeologists claim that extremely ancient cultural remains exist in the New World, it is appropriate to give a brief textbook account of the basic early cultures of the Old World to which New World finds have been compared (Fagan 1986, 1987; Wenke 1985).

As is well known, the earliest convincing evidence of ancestral human beings comes from Africa. At Afar, Ethiopia, deposits containing femur and skull fragments of *Australopithecus afarensis* have been found in deposits K-Ar dated between 3.9 and 4.1 million years ago. Though questions remain about precise evolutionary relationships among the populations represented by these and related fossil remains, the human lineage is clearly traceable at least this far back in time. At Koobi Fora, Kenya, deposits dated roughly 1.8 million years ago yielded a skull assigned to the early human species *Homo habilis*, and at another place nearby the remains of a hippo butchered with small stone knives, crudely flaked choppers, and pebble hammers. These earliest stone tools were extremely simple: battered and broken pebbles, and flakes removed from them.

Bones of *Homo erectus* have been found at East Turkana, Kenya, in a geological context dated about 1.5 to 1.6 million years ago. Well-made bifacially flaked Acheulian handaxes belonging to the time of *Homo erectus* are found all over Africa, in the south of Europe, and eastward into peninsular India. At the site of Zhoukoudian near Beijing in northern China, in deposits dating between 500,000 and 350,000 years ago, numerous *Homo erectus* fossils were found associated with simpler stone tools and abundant split and burned bone of large and small animals. Thus during the *Homo erectus* stage humanity expanded from the tropics and subtropics into the north temperate zone, making use of fire and stone artifacts and no doubt other equipment to cope with the demands of more climatically and seasonally rigorous environments .

Human adaptation to ever more northerly environments continued during Middle Paleolithic times. Skullcaps of *Homo sapiens* from Swanscombe, England, and Steinheim, Germany, represent humans of early modern form who were living in mid-latitude Europe by about 200,000 years ago. The Neandertals, another variety of early *Homo sapiens*, appeared in Europe around 100,000 years ago. They struck flakes from prepared cores, shaped them into a variety of forms, and hafted some of them to make composite tools — spears, knives, and scrapers. This lithic industry is called Mousterian. The cutters and scrapers, and the fact that some Neandertals lived quite far to the north in Europe (during interglacial periods, to be sure), suggest that they probably also fashioned clothing of animal hides.

Fully modern *Homo sapiens* appeared in Europe about 35,000 years ago. The lithic industry of these people, labeled Aurignacian, was made on long, slender parallel-sided stone blades struck from prepared cores. These Aurignacian blades were used in arming a wide variety of composite tools — knives, harpoons, atlatl darts, spears. People of this tradition were hunters of mammoth, horse, reindeer, and other large herding animals adapted to the arctic tundra vegetation that then prevailed over much of Europe and northern Asia. Hunters using Aurignacian-like core-and-blade lithic technologies became widespread throughout northern Eurasia during the last glacial period, extending as far as Japan and northeasternmost Siberia. They were well adapted to a life of big game hunting under cold arctic conditions, as shown most clearly by several sites in the Soviet Union where archaeologists have uncovered their semisubterranean houses framed with the ribs and long bones of elephants and other prey.

3 Stopping Places on the Way to America

A growing number of archaeological site studies documents the terminal Pleistocene expansion of the human species into northern Eurasia. The sites mentioned below illustrate a northward and eastward progression of archaeological complexes dated between about 30,000 and 10,000 years ago. While of course it is not established that these sites were literally "stopping places" of immigrant peoples, they do represent in a general way the pioneering cultures that the first humans carried into uttermost Asia and ultimately into the New World across the Bering land bridge.

Ust' Kanskaia Cave, Siberia: The cave of Ust' Kanskaia is in the Altai Mountains, on the Ob River. Bones of rhino, horse, sheep, yak,

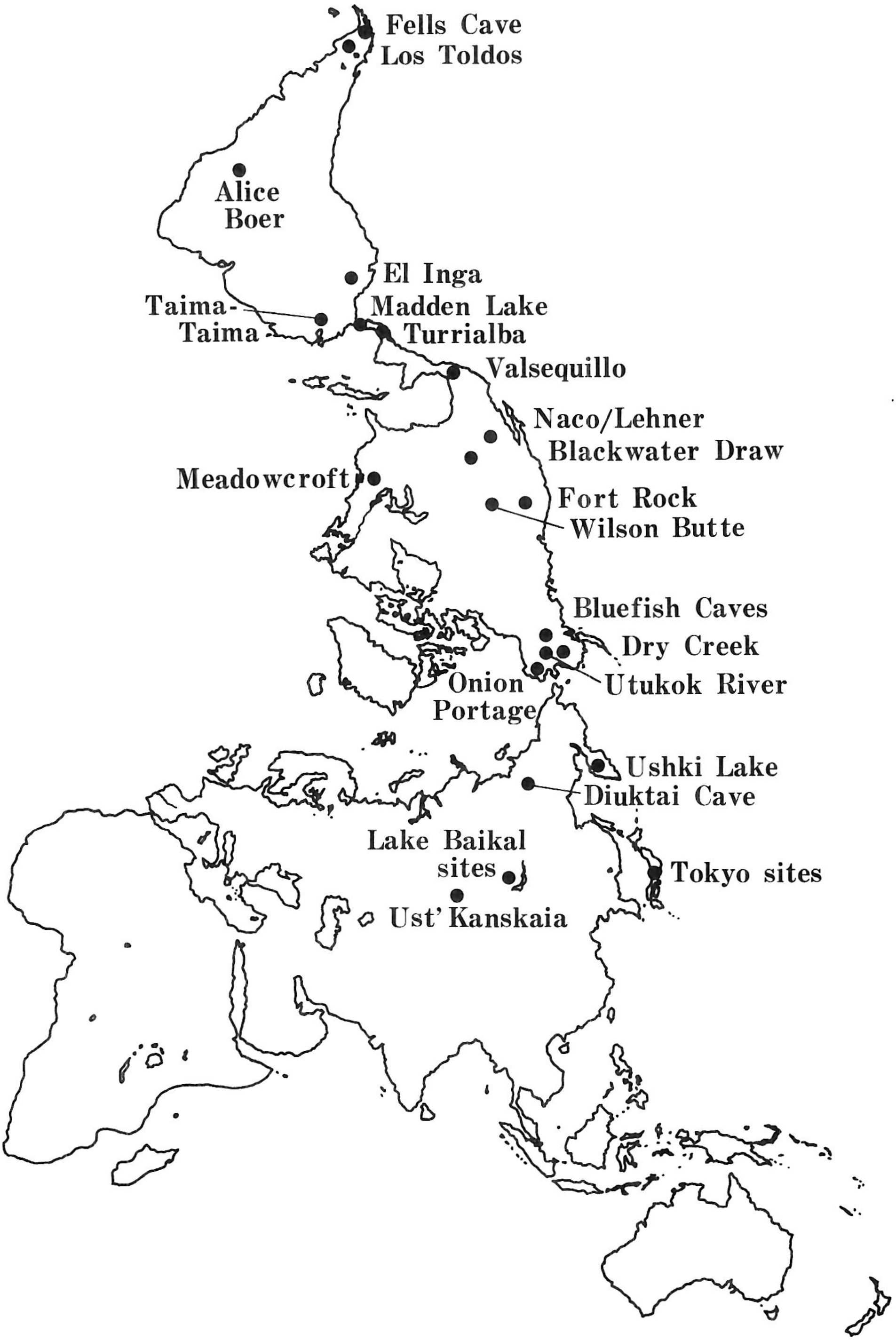

Figure 1. **Stopping places on the way to the New World: terminal Pleistocene archaeological sites of Northeast Asia and the Americas.**

gazelle, antelope, fox, badger, marmot, and hare suggest that it dates to a warm phase prior to the last glacial maximum, probably about 33,000 to 30,000 years ago. The species recovered attest the hunting of both large and small game in a steppe-grassland setting. Tools included Mousterian-like large flakes, discoid choppers, small biface handaxes, scrapers, and uniface points; there were also some Aurignacian-like blades, and burins made on blades (Müller-Beck 1966).

Lake Baikal Paleolithic: The Mal'ta-Afontova Gora tradition, dating about 20,000 to 15,000 years ago, has a stone tool industry combining both Mousterian and Aurignacian-like flake and blade tools. Leaf-shaped biface points are also present. The remains of semisubterranean houses (both round and elongate) have been found. People hunted large game, as attested by abundant bones of mammoth and other species. Bone sewing needles, and an ivory carving showing a person in a parka with peaked hood, indicate the use of Eskimo-like tailored skin clothing (Chard 1974: 18–30).

Verkholenskaia Gora: The stone tool assemblage at Verkholenskaia Gora, C-14 dated to about 12,500 years ago, included Aurignacian-like blade tools comparable to those of the earlier Lake Baikal sites. But most importantly, it also contained abundant evidence of a highly distinctive new technology of microcores and microblades. This microblade technology is in fact represented at many sites in Siberia, northern China, and Japan; an important additional association at Verkholenskaia Gora, where factors of preservation were favorable, is barbed harpoon points of bone and antler, and many fish bones (Chard 1974: 33–36). It appears from this that the new technology accompanied new forms of economic exploitation that began to appear in Northeast Asia during the waning centuries of the glacial age (Aikens 1990).

Japanese Paleolithic: In Japan, the appearance of large Aurignacian-like blade tools, and the subsequent transition to microblades, is also well attested at many sites. Most importantly, the Japanese sequence is well dated by geologic evidence, obsidian fission-track dates, and numerous radiocarbon determinations. The site of Nakazanya, in Tokyo, gives evidence between 25,000 and 28,000 years ago of people who made small nondescript flake tools that were vaguely Mousterian-like. Between 25,000 and 18,000 years ago, such sites as Nakazanya, Nogawa, Heidaizaka, Iwajuku, and many others give evidence of a well-established Aurignacian-like lithic tradition throughout Japan. After about 18,000 years ago leaf-shaped biface points also begin to occur, and after about 14,000 years ago, there appears a well-defined microblade tradition with conical and wedge-shaped cores (Aikens and Higuchi 1982: 43–86, with references).

Diuktai Tradition, Aldan River, Eastern Siberia: Diuktai Cave, with C-14 dates between 14,000 and 12,700 years ago, contains foliate biface points, triangular biface knives, and wedge-shaped microcores and blades. The bones of mammoth, bison, musk ox, and horse are present in the forecave area. At the nearby sites of Ust' Mil' and Ikhine, C-14 dates ranging from 35,000 to 23,000 years ago have been obtained; circumstances of excavation and artifact associations are unclear, but the excavator uses these dates to postulate the existence of a "Diuktai tradition" from 35,000 to 13,000 years ago. Such an early dating for this tradition, however, is highly questionable (Chard 1974: 33; Mochanov 1978; see also discussion in Morlan 1987: 273–280).

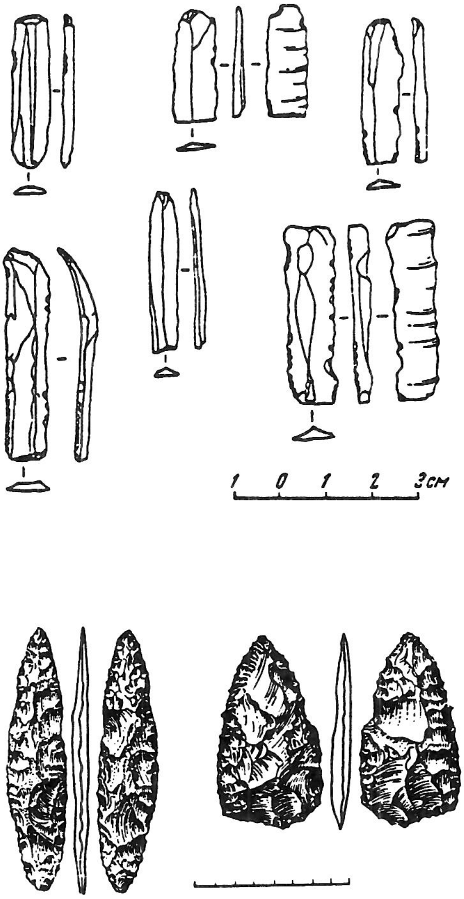

Figure 2. Blade tools and bifaces from Diuktai Cave, Yakutia. From Mochanov (1970); redrawn from Powers (1973: Figs. 38, 39).

Ushki Lake, Kamchatka: Ushki Lake, near the western edge of the Beringian region, yielded two complexes of interest. Early Ushki I revealed traces of two adjoining huts, with which were associated stemmed arrowpoints, spearheads, and knives (mainly bifaces), as well as scrapers, subprismatic cores, beads, and pendants. It has C-14 dates of 14,300 and 13,600 years ago. Later Ushki I is dated to 10,360 years ago. The remains of 13 dwellings of this period included large above-ground structures and smaller ones slightly sunken in the ground, with long entrance passages. Associated with these dwellings were wedge-shaped microcores, narrow leaf-shaped biface points, a grinding stone, and some pendants. Salmon bones were also found in some quantity. The excavator relates the earlier occupation to such early American complexes of the continental interior as Marmes Rockshelter in the state of Washington, and the later occupation to the American Paleo-Arctic tradition of Alaska (Dikov 1978: 68–69).

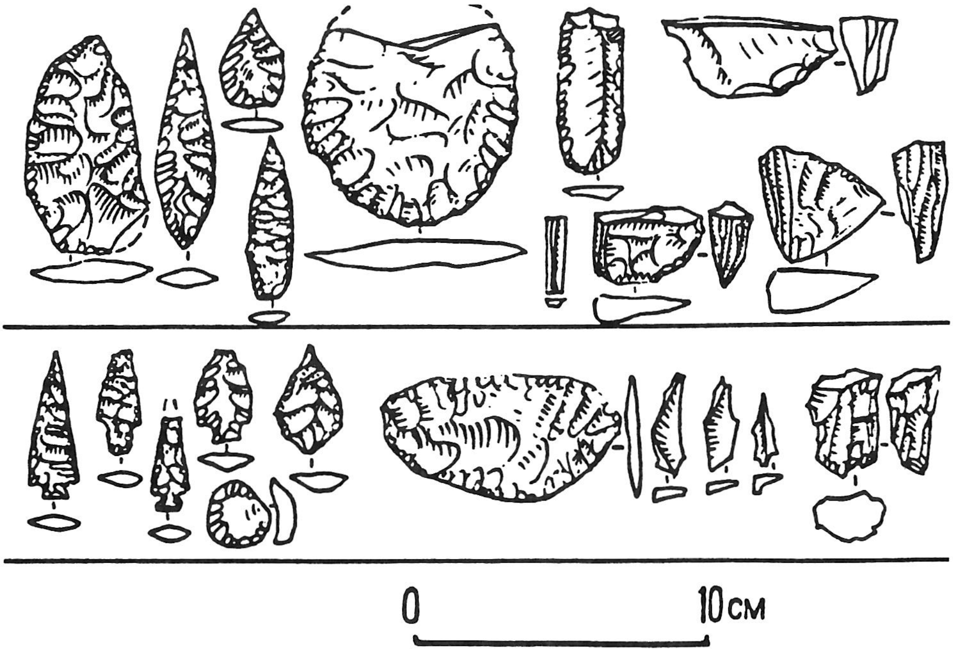

Figure 3. Blade tools, bifaces, and microcores from Ushki Lake, Kamchatka. Redrawn from Dikov (1978: Fig. 1).

4 Beringia – Crossing to the New World

Beringia denotes not only the area now under the Bering Sea, but much of Alaska as well, and an area of comparable size on the Soviet side of the Bering Strait. The Beringian flora and fauna are known from studies of vertebrate paleontology and fossil pollen on either side of the strait, and the undersea geography is known from mapping of the sea floor.

Some 90 kilometers of water now separate Siberia from Alaska. On a clear day, from the heights of Cape Prince of Wales in Alaska, Cape Dezhnev in Siberia can be descried. The water of the strait itself is about 60 meters deep, but the whole Bering platform is less than 180 meters below modern sea level. Lowered sea levels at the time of the last glacial maximum, 18,000 years ago, exposed a plain more than 1000 kilometers across (Hopkins 1967).

An ambitious synthesis of Beringian climatic and environmental history depicts conditions in the region at various intervals (Hopkins 1982; Schweger *et al.* 1982). In terms of the argument to be explored here, the most likely time of first human entry was during the transition between the Duvanny Yar Interval and the subsequent Birch Zone.

The Happy Interval, about 120,000 to 60,000 years ago, was a glacial/periglacial interval, including a major period of lowered sea level. Little is known about it.

The Boutellier Interval, about 60,000 to 30,000 years ago, was a non-glacial period, with a climate milder and more mesic than at any other time between the last interglacial and the Holocene. Vegetation included meadows and steppe-tundra on the uplands, shrub thickets on floodplains, open woodlands on some slopes, lines of trees along riverbanks. Animals were numerous and diverse, including mammoth, rhino, bison, musk ox, antelope, elk, reindeer, camel, horse, hare, marmot, and many smaller mammals.

The Duvanny Yar Interval, about 30,000 to 13,500 years ago, spanned the period of the last glacial maximum, with glaciation peaking about 18,000 years ago. At this time, Beringia was the easternmost province of an unglaciated zone that extended westward across Siberia and ultimately into central and western Europe. Temperatures were low, and snowfall limited. Vegetation was sparse, dominated by sagebrush and grasses, willow thickets along streams and in other low-lying wet spots, and pockets of shrub vegetation in favorable “hot spots.” Fauna was more diverse than the present Beringian fauna, but less so than that of the Boutellier interval, and numbers were evidently much less. Mammoth, rhino, musk ox, bison, horse, antelope, and reindeer were present.

The Birch Zone, 13,500 to 9000 years ago, marks the end of the Pleistocene in Beringia, with rapid warming attested by birch and other shrub and tree pollens. Vegetation became richer, and smaller mammalian fauna flourished, but the mammoth, horse, and wooly rhino dwindled and disappeared.

A Beringian land bridge has existed many times during the Pleistocene, as sea waters rose and fell with glacial growth and melting. The last of these, dated between about 25,000 and 14,000 years ago, is the one of most interest here in connection with the peopling of the New World (Schweger *et al.* 1982). The earliest good archaeological evidence yet available for far Northeast Asia, at Diuktai Cave in Yakutia and Ushki Lake in Kamchatka, does not show human beings to have been present in the Beringian region until about the end of the harsh, cold Duvanny Yar interval. It thus seems likely — based on currently known archaeological complexes and dates (see continuing discussion below) — that amelioration of the rigorous Duvanny Yar climate, leading into the time of the milder and biotically richer Birch Zone, facilitated the pioneering human penetration of Beringia and the New World.

5 Early Sites at the Gateway to America

Dry Creek, Alaska: On the American side of Beringia the Dry Creek site, about 180 kilometers southwest of Fairbanks, has yielded two early components of interest. The Dry Creek 1assemblage included a considerable number of flakes, a large blade-like flake, a flake core, a small triangular biface, 2 burins, a chopper, and 6 scrapers. There is one C-14 date of 11,120 years ago for Loess 2, where this assemblage occurred. Subsequent work in central Alaska has yielded further evidence of similar character, leading to the definition of a Nenana Complex dated by several C-14 determinations in the 11,000-year range (Powers and Hoffecker 1989).

The Dry Creek 2 assemblage included a large number of flakes, 8 large blades, 11 microblades, 2 wedge-shaped microcores, 7 scrapers, 2 choppers, 4 elongate bifaces, and an asymmetrical projectile point. A C-14 date from Loess 3, containing this assemblage, is 10,690 years ago (Powers and Hamilton 1978). This component is referable to a widespread microblade horizon termed the American Paleo-Arctic tradition (see below).

Putu, Girls Hill, and Utukok River: All of these central Alaskan sites have yielded fragmentary but identifiable specimens of Clovis fluted points. Clovis points are dated between about 11,500 and 11,000 years ago at sites far to the south in interior North America. Putu has yielded a C-14 date of about 11,500 years ago on an apparent hearth, but the association of Clovis point and hearth is not firmly established (Dumond 1980, with references).

Onion Portage, Alaska: Onion Portage, an open site on the Kobuk River, yielded two early complexes of the American Paleo-Arctic tradition. The Akmak complex, with a C-14 date of 9900 years ago, contained large blades and cores, bifacial knives, end-scrapers, and gouges. Wedge-shaped microcores were also found. The Kobuk complex, clearly a later development out of the Akmak complex and C-14 dated between 8500 and 8100 years ago, was dominated by wedge-shaped microcores and microblades (Anderson 1968, 1970).

Bluefish Caves, Alaska: The Bluefish Caves in eastern Alaska have yielded flakes, bifaces, and wedge-shaped microcores from a complex deposit that has been characterized as a "palimpsest." Some 16 radiocarbon dates on bone have been obtained that span an interval between 25,000 and 12,000 years ago, but discrete, datable archaeological components have not been identified. The implications of this potentially important site for understanding early Beringian occupation remain to be clarified (Morlan and Cinq-Mars 1982: 368; Morlan 1987: 285–287).

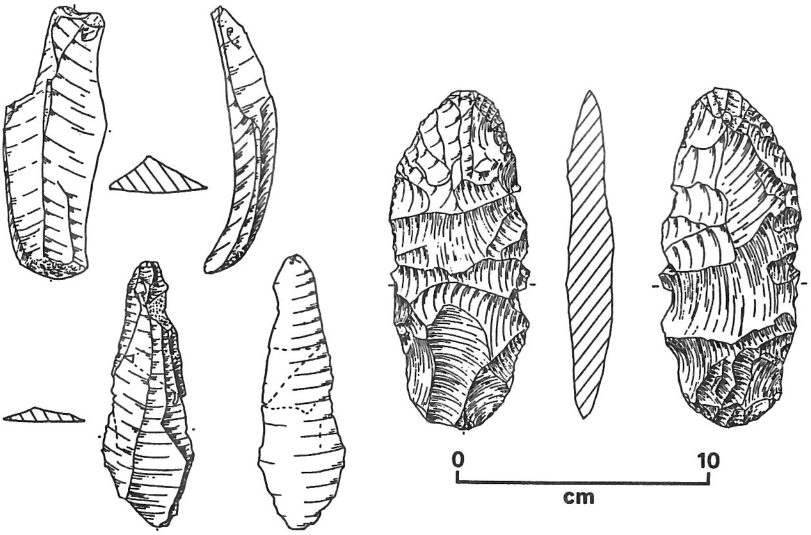

Figure 4. Blades and bifaces of the Akmak Complex, Onion Portage, Alaska. Redrawn from Anderson (1970: Figs. 27, 43).

6 The Most Probable Time of First Human Entry into the New World

A two-part cultural sequence for early Beringia can be read out of the data just reviewed from Onion Portage in Alaska, Ushki Lake and Diuktai Cave on the Soviet side, and other evidence farther south in both Asia and America. The first stage in the sequence is indicated by assemblages containing large blades and bifaces. The second stage is indicated by similar assemblages to which wedge-shaped microcores and microblades have been added.

Occupation of cold northern settings between 20,000 and 15,000 years ago has long been demonstrated by the Lake Baikal Paleolithic, where large blades predominate and some leaf-shaped bifacial tools were also found. Dates from Japan place the appearance of large blades there between 25,000 and 18,000 years ago, with blades continuing strongly and bifaces increasingly present after about 18,000 years ago. Early Ushki Lake in Kamchatka gives evidence of large blades and bifaces in that far northern place at about 14,300 to 13,600 years ago. Thus the most likely time range for the appearance of large blade and biface assemblages in Northeast Asia would seem to fall between about 18,000 and 14,000 years ago, though it might extend several millennia earlier.

Earliest Diuktai Cave, dated about 13,000 years ago, and the Akmak assemblage from Onion Portage, dated about 10,000 years ago, are also characterized by large blades and bifaces. But importantly, they contain in addition some wedge-shaped microcores and microblades. Dates from Japan, where a number of dated sites are known, place the appearance of microblades farther south around 14,000 years ago. Microblades had apparently not yet arrived in the Beringian region at this time, as shown by their absence in the early Ushki Lake assemblage, but they arrived soon after. Between about 13,000 and 10,000 years ago microblades and wedge-shaped microcores became prevalent in Beringia, as indicated by the dated assemblages from Diuktai Cave, a later occupation at Ushki Lake, and Onion Portage.

The importance of this situation for assessing the most likely time of first human entry into America hinges on the fact that large blades and bifaces are characteristic of the Clovis Paleo-Indian complex known from the American interior, but microcores and microblades are completely absent there. In other words, it is evident that early large blade and biface complexes must have been carried across Beringia and south into the American heartland at a time prior to the arrival in Beringia of the wedge-shaped microcore complex.[1] This means, in terms of current Asian/Alaskan archaeological data, some time between about 18,000 and 14,000 years ago (see also Dumond 1980; Aikens and Dumond 1986).

7 The North American Continental Ice Corridor

Glacial ice probably blocked off the eastern end of Beringia along roughly the present Alaska-Canada border during the last glacial maximum about 18,000 years ago. At places along the entire length of British Columbia, moraines, tills, and outwash features of the terminal Pleistocene Laurentide and Cordilleran ice sheets come in contact. This suggests that the two great glaciers at their maximum extent flowed together to make a continuous ice field that would have completely blocked the way southward for human travellers. But according to some authorities, during each of the Pleistocene glacial advances the Cordilleran ice appears to have passed its maximum and been in a state of retreat before Laurentide ice had flowed that far to the west. Thus, the corridor leading southward between the two glaciers was probably blocked for only relatively brief periods (Rutter 1982). Some data suggest an interval between about 20,000 and 19,000 years ago when the corridor was open, followed by a glacial readvance that would have closed it off again until the final retreat of Pleistocene ice that was proceeding rapidly by about 14,000 years ago (Stalker 1982). This evidence is thus congruent with the inference from dated Asian/Alaskan archaeological finds that the most probable time of initial human penetration into the North American interior is between about 18,000 and 14,000 years ago.[2]

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[1] Meltzer (1989:483) speculates that a series of unrelated New World migrations that failed to leave descendents might, if archaeologically detected, manifest quite disparate remains. Although this is logically correct, in terms of the argument here it is important to note that for pre-Clovis New World assemblages *not* to contain large blade tools, they would have had to be brought across Beringia before blade technology became widespread in northern Eurasia. While such an antiquity for human occupation in Asia's farthest north is conceivable, currently available evidence gives no warrant for thinking it at all likely.

[2] The idea that early people adapted to a maritime lifeway might have first entered America along the Northwest Coast (Fladmark 1979), is imponderable. Although the case is logically argued, there is simply no evidence for Pleistocene-age maritime adaptation anywhere in the North Pacific region.

8 Fluted Clovis and Magellan Points in Continental America South of the Ice

As already implied in the preceding discussion, the earliest unequivocally established archaeological complex in North America is that known as Clovis. These Paleo-Indian hunters ranged all over the continent, as shown by finds of their distinctive fluted lanceolate spear points from sites as far apart as Alaska, Nova Scotia, California, and Costa Rica. Recently, specimens have been found in South America as well. The sites below exemplify the basic pattern.

Blackwater Draw #1, Clovis, New Mexico: Blackwater Draw is the type locality for the Clovis complex, originally discovered in 1932 during mining for gravel in an old spring-fed pond. In more recent work the Clovis layer, a sand deposit laid down by spring outflow, was C-14 dated at 11,630 years ago and 11,040 years ago. Four mammoths lay on the gravels of an old stream bed at El Llano Locality, facing downstream. One bison of a form now extinct lay in the same position. The bones of a front and back foot, buried in a vertical position, suggest that the bison had become mired down, and was killed and butchered on the spot. Other bones were of horse, antelope, peccary, deer, wolf, turtle, rodents, and birds. Associated artifacts included small triangular Clovis fluted points, large lanceolate Clovis fluted points, large Aurignacian-like blades and end scrapers made on blades, flake scrapers, gravers, cores, flakes, hammerstones, and worked bone. Nearly half of the specimens were of Alibates chert, a distinctive kind of toolstone obtained from a quarry 100 miles away in the Texas panhandle (Green 1963).

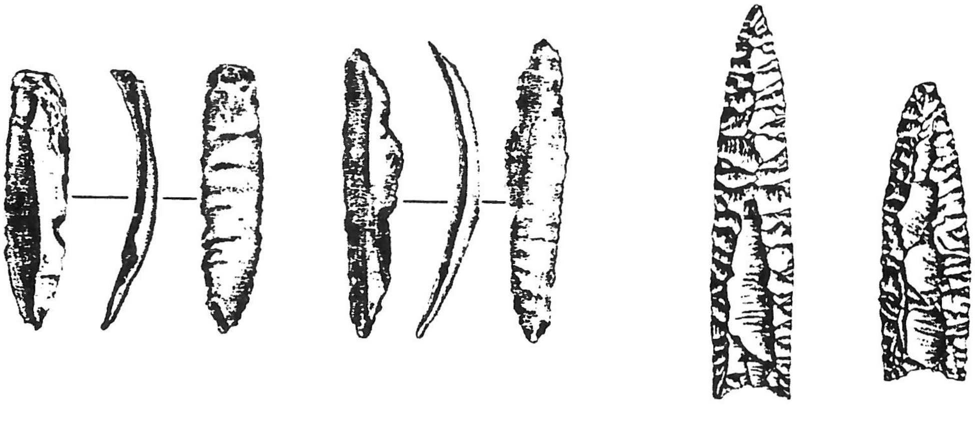

Figure 5. Blades and Clovis fluted points from Blackwater Draw #1, New Mexico. Redrawn from Jennings (1983: Figs. 2.11, 2.12).

Naco, Arizona: Near the small town of Naco, not far from the Mexican border, was excavated a mammoth that had died on a sandy stream bottom and was later covered by pond deposits. It had been killed by eight Clovis points, which archaeologists found at the base of the skull, near the left shoulder, between the ribs, and against the atlas vertebra (Haury *et al.* 1953).

Lehner, Arizona: This site, on the Lehner Ranch in southern Arizona, revealed a large bone bed containing mammoth, tapir, bison, and horse, along with 13 Clovis points, 8 cutting-scraping tools, 2 fire hearths, and an ivory shaft-straightening wrench. A series of highly consistent C-14 dates were 11,300 years ago, 11,250 years ago, 11,200 years ago, 11,200 years ago, and 10,950 years ago. Pollen studies revealed a spectrum of plants still present at higher elevations on the Lehner Ranch today, implying a slightly cooler, moister climate at the time of occupation than that now known at the site (Haury *et al.* 1959; Haynes 1969).

Turrialba, Costa Rica; and Madden Lake, Panama. Complete and fragmentary fluted points of Clovis type found at Turrialba and Madden Lake establish the Clovis presence in Central America. Importantly, Madden Lake also yielded fluted points of another variety, which compare closely with the Magellan or "fishtail" points known from Fells Cave at the extreme tip of South America (Bird and Cooke 1978; Snarskis 1979).

El Inga, Ecuador: In the highlands east of Quito, a largely surface site has yielded a large lithic assemblage including unifacial flakes, blades, and burins, as well as biface projectile points of several types. Most common and probably earliest were those of the Magellan type. Some of the El Inga specimens are fluted, like North American Clovis points. El Inga was occupied over a long period of time, but the site chronology is not well understood. C-14 dates for the site range from 9030 years ago to 3430 years ago, and obsidian hydration dates from 9321 years ago to 11,248 years ago (Mayer-Oakes 1986).

Fells Cave, Patagonia. In Fells Cave, overlooking the Strait of Magellan at the tip of South America, the earliest deposits were sealed by a layer of roof-fall rock. Beneath this layer were found Paleo-Indian "fishtail" or Magellan points, associated with the bones of horse, giant ground sloth, and camel. C-14 dates on charcoal were about 11,000 and 10,720 years ago (Bird 1938; Lynch 1983: 117).

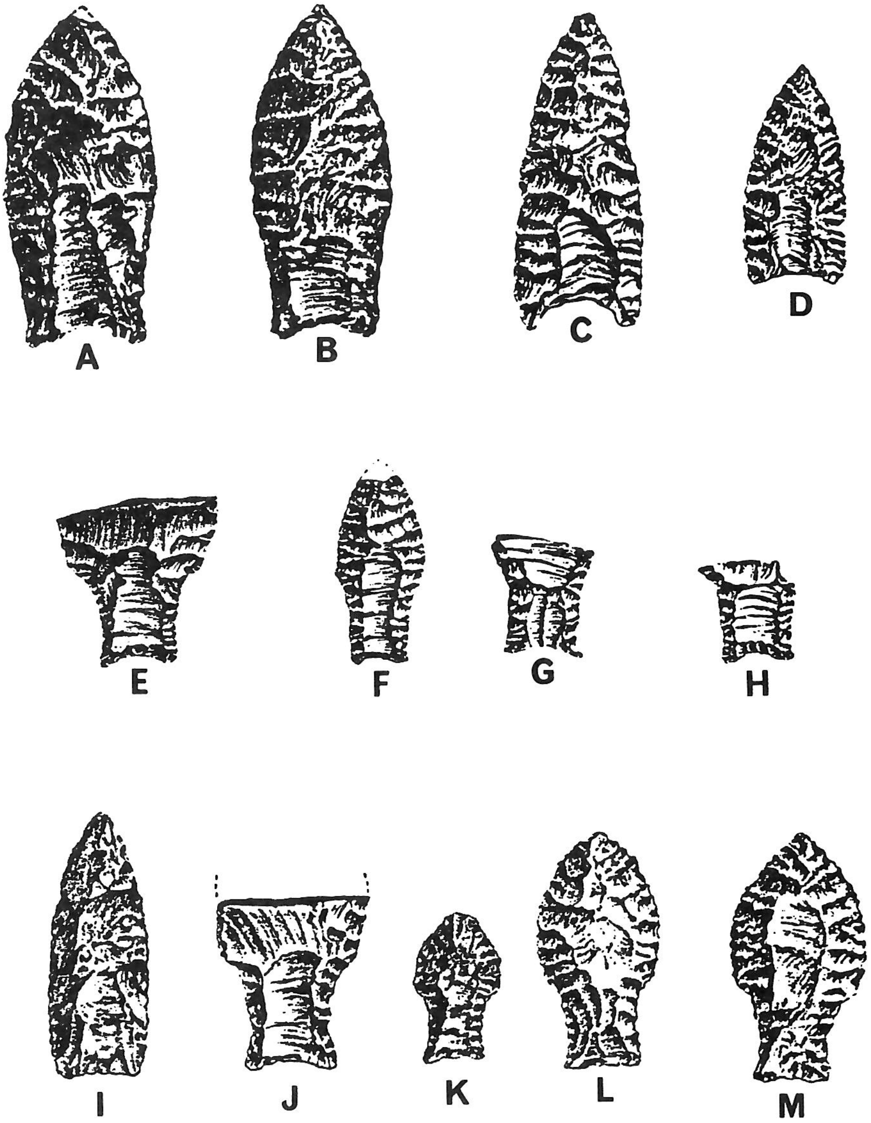

Figure 6. **Fluted Clovis, fishtail points, and Magellan points from Central and South America.**
A, San Rafael, Guatemala; B, Turrialba, Cost Rica; C, D, Nochaco, Ecuador; E, F, G, H, El Inga, Ecuador; I, J, K, L, M, Fells Cave, Patagonia. Redrawn from Lynch (1983: Figs. 3.4–3.6).

9 Megafaunal Extinctions: Pleistocene Overkill?

Extinction of the Pleistocene megafauna in America seems to have occurred by about 11,000 years ago. By then, the mammoth, mastodon, ground sloth, horse, and camel were gone, and the giant bison followed within another thousand years or so. It has been argued that these extinctions were caused by the predation of a Paleo-Indian population that entered the North American heartland about 11,500 years ago, grew explosively, and quickly hunted out the large game animals. This view asserts that climatic change cannot adequately explain the postglacial extinctions, because these species had survived interglacial changes of climate many times before. It stresses as a crucial new factor the first appearance of human hunters:

> The global pattern of extinctions of all large land mammals appears to follow Paleolithic man's footsteps. Africa and southern parts of Asia were affected first with losses among the suids, primates, equids, and giraffids at the end of the Acheulian, perhaps 200,000 years ago. Australia followed with the extinction between 40,000 and 20,000 years ago of twelve genera of giant marsupials and size reduction among the surviving groups of large marsupials. Between 20,000 and 10,000 years ago Europe and northern Asia were affected, to a relatively slight degree. North and South America were stripped of large herbivores, apparently suddenly, between 12,000 and 10,000 years ago, with only extinct species of Bison persisting into the Holocene. Intensity of extinction appears to have been heavier on the American and Australian continents than in Africa and Asia. Extinctions continued into the Holocene on oceanic islands, affecting birds and mammals of a smaller size than those lost on the continents. (Martin 1982: 400).

As briefly reviewed above, early fluted projectile points have been found throughout the western hemisphere. The Clovis type is dominant in North America, the Magellan type in South America. Many archaeologists see this as the first well-demonstrated American cultural horizon. The overkill theory suggests that the fluted point tradition represents the arrival of the first Americans, who grew rapidly in numbers and swept over the hemisphere within less than 1,000 years, driving the

Pleistocene megafauna to extinction (Mosimann and Martin 1975).

The overkill hypothesis is highly controversial. Most importantly, it neglects biotic evidence and ecological considerations that explain in much less simplistic (and therefore more plausible) terms a wave of terminal Pleistocene extinction that in fact led to the disappearance of not only large mammals but also ten genera of birds and many kinds of small mammals that were most probably neither human prey nor ecologically dependent on the megafauna (Grayson 1983; Meltzer and Mead 1985). Another fundamental difficulty with the idea is the fact that a number of sites in both North and South America appear to be significantly older than the 11,500 years thought to mark the beginning of the fluted point horizon.

10 A Pre-Clovis Horizon?

Many claims have been made for pre-Clovis occupation in the New World, perhaps extending back as much as 300,000 years ago. These claims may be grouped into four general categories, according to the kinds of evidence offered. The sites mentioned here are merely some prominent examples among many more that could be adduced (e.g., Bryan 1978; Ericson *et al.* 1982; Bryan 1986).

Group 1: Geological Contexts Ancient, Specimens Questionable

Calico Hills, California: The Calico Hills site is situated on an old alluvial fan in the southern California desert near San Bernardino. Master Pits I and II have been carried to a maximum depth of 11 meters; work has continued since 1964, though the major digging was done by 1972. The age of the deposits is variously estimated on different bases at 80 to 125,000 years (stratigraphic indicators), at 200,000 years (uranium-thorium assay), and at 600,000 to 700,000 years (degree of weathering). The fan is obviously ancient, though its actual age remains unclear.

Investigators identify as artifacts more than 1000 tools and 2000 "technical flakes," including handaxes, chopping tools, choppers, scrapers, cutting tools, burins, gravers, piercing tools, multi-purpose tools, and anvils. Technically significant flakes are said to include hinge flakes, flakes with bulb scars, corner-struck and side-struck flakes, burin spalls, blades, and bladelets. Evidence of soft hammer percussion and bipolar flaking is also said to be present. The assemblage has been compared with that from the Lower Paleolithic site of Zhoukoudian, China (Simpson 1978; Simpson *et al.* 1986).

According to another view however, the specimens from Calico are not artifacts at all, but geofacts — specimens of the naturally-occurring chert common in the alluvial fan, broken up as stones were tumbled and eroded in the mud flows and flash floods which built up the fan during late Pleistocene times. As has been pointed out, it is not surprising that a number of artifact-like specimens could be sorted out of the many thousands of broken stones taken from the two master pits (Haynes 1973; Payen 1982).

Texas Street, California: Exposed in a cutbank along a Pleistocene alluvial terrace of the San Diego River were many burned areas that some have interpreted as fire hearths. A C-14 date in excess of 35,000 years ago is reported from one of these areas, and on geological grounds the alluvial deposits are dated to a period 80,000 to 120,000 years ago. Within the geological section, and particularly from erosional accumulations at the base of the cutbank, have been collected crudely fractured quartzite cobbles claimed to be ancient artifacts (Carter 1957; Reeves *et al.* 1986). Despite renewed recent work, however, the most likely possibility remains that the fractured quartzite specimens are “geofacts” naturally broken by alluvial processes, and that the burned areas reflect the natural brush fires that are endemic to the southern California coast even today (Johnson and Miller 1958; Cruxent 1962).

Old Crow Flats, Alaska: Along the Old Crow River in eastern Alaska are many riverbank exposures of Pleistocene sediments, some up to 70 meters high. Thousands of bones have been identified in these exposures (near Locality 11 alone, more than 20,000 fossil bones were recovered). Many bones are fractured, including quite a few with curvilinear (putatively “man-made”) rather than angular (“natural”) fractures. It has been argued that these represent a primitive, early bone-working industry (Bonnichsen 1979). Certain specimens are seen as indicating reduction of a bone into large fragments, preparation of a striking platform, and removal of one or several flakes that could be used as cutting tools. Marks interpreted as evidence of grooving, scraping, and grinding have also been observed on several dozen specimens. A series of C-14 ages on Old Crow bones ranges from greater than 39,000 years ago to 4570 years ago (Irving and Harington 1973; Bonnichsen 1979; Irving 1986; Morlan 1986).

But there are strong grounds for skepticism about the Old Crow claims. As at Calico Hills, a few specimens broken in a way that suggests human workmanship were sorted by archaeologists from thousands of others that were clearly not so worked. Fossil bones eroded from the banks of the Old Crow River have been broken up to varying degrees as they tumbled downstream in spring floods and washed up in point-bar deposits, where archaeologists found them. A C-14 date of 27,000 years ago was reported for a fleshing tool from Old Crow Flats that had been made on a caribou tibia (Irving and Harington 1973). This was undeniably an artifact, but many were skeptical of the reported date, because fleshers of the same type were still being made in late prehistoric times. A new C-14 date of 1350 years ago obtained by accelerator mass spectrometry (AMS) shows the Old Crow flesher to be of late prehistoric age, congruent with other similar specimens. Needless to say, the new dating seriously weakens the case for early human occupation at Old Crow Flats. Of all the specimens examined, only four were clearly identified as artifacts, and these have now been C-14 dated by the AMS method to late prehistoric times. The dates are: caribou tibia flesher, 1350 years ago; caribou antler wedge, 1730 years ago; caribou antler wedge, 1880 years ago; caribou antler billet, 2930 years ago (Nelson *et al.* 1986).

Group 2: Things Not What They Seem

Blacks Fork, Wyoming: Studies by a French-trained prehistorian in southwestern Wyoming during the 1930s led to the identification of Blacks Fork Typical, Peripheral, and Sand Dune cultures. These he took, on the European model, to represent cultural evolution from earliest Paleolithic to quite recent prehistoric times. The Typical culture was comprised of crudely flaked pebbles from desert pavements of the Lyman surface, a geomorphic unit of Pleistocene age. The specimens were said to resemble some of the earliest and crudest tools of the Old World Paleolithic. The Peripheral culture was represented by well-flaked core bifaces typologically identical to Acheulian handaxes, known to occur as early as the middle Pleistocene in the Old World. Flakes and other pieces were also part of this assemblage, which was invariably found near outcrops of Bridger Basin tiger chert. Seen as most recent was the Sand Dune culture, represented by large and small bifacial projectile points, scrapers, bones, fire hearths, and occasionally pottery (Renaud 1936, 1938, 1940, 1947, cited in Sharrock 1966).

A later restudy of the area, and excavations at the Pine Spring site there, led a second observer to a quite different interpretation of the same evidence (Sharrock 1966). He concluded that the Typical culture was in fact a highly selected sample of artifact-like specimens taken from naturally split and broken glacial outwash gravels eroded from nearby mountains. Peripheral culture sites were reinterpreted as quarry-workshops where chert nodules were broken away from outcrops and roughly shaped into preliminary biface quarry blanks. It was noted during investigations at the Pine Spring site that broken and discarded quarry blanks found near the associated chert outcrop closely resembled Acheulian handaxes, while more refined, finished tools of the same material — and the flakes struck off during their manufacture — were found in the stratified camp deposits around the spring. Finally, it was concluded that the Sand Dune culture simply represents the culture of the last 10,000 years; typical specimens of this culture came from throughout the stratified deposits at Pine Spring. In short, the Typical culture was not a culture at all, and the Peripheral culture represented specialized stone-working industrial sites used by the Sand Dune culture people whose occupation sites are all Holocene in age.

Manix Lake, California: On a land surface above the highest beach line of Pleistocene Lake Manix in the southern California desert, many large flaked stone artifacts were found embedded in a desert pavement. The specimens, which were heavily patinated, included bifaces closely resembling the Acheulian handaxes of the Old World Paleolithic. Other large, simple specimens were interpreted as side-scrapers, end-scrapers, and choppers (Simpson 1958). As at Pine Spring, subsequent lithic technology studies showed quite clearly that the Manix Lake site is a workshop where naturally occurring cherts selected from the desert pavement were worked into quarry blanks for later finishing elsewhere (Glennan 1976).

There are many other sites of this character in the New World, which have been mistakenly identified as paleolithic occupations because they yield specimens that are undeniably similar to those of the Old World Acheulian (Krieger 1964; Sharrock 1966). The markedly “Acheulian” character of the Pine Spring and Manix Lake quarry specimens was certified by no lesser Old World experts than J. Desmond Clark and L.S.B. Leakey, respectively. Nevertheless, it is clear that typology cannot be taken as proof of age in cases where there is no reliable geologic or radiometric dating evidence.

Group 3: Indisputable Specimens, Dubious Dates

AMS C-14 Dates for Putatively Early Human Skeletons: A number of human skeletons (all of fully modern *H. sapiens* type) from California and elsewhere, once assigned ages of up to 70,000 years based on the aspartic acid racemization (AAR) dating method, have recently been re-evaluated. AMS C-14 dating of the bones now shows that none are older than 8000 years at most, eliminating them from consideration as evidence of really early human occupation (Taylor *et al.* 1985):

Skeleton	AAR Age years ago	AMS C-14 Age years ago
Sunnyvale	70,000	3600/4850
Angeles Mesa	>50,000	4050/7900
Del Mar	41/48,000	4900
San Jacinto	37,000	3020
Otavalo (Ecuador)	25,000	2300/2670
Taber (Canada)	28,000	3550
LaJolla Shores	28,000	1700/1930
Los Angeles	>23,000	3560
Yuha	23,600	1650/3850
Truckhaven	23,600	< 500
Laguna Beach	14,800/17,150	5100

Group 4: Good Possibilities for Pre-Clovis Age

Meadowcroft Rockshelter, Pennsylvania: This site, excavated with unusually good technical control, yielded a long stratigraphic sequence containing Archaic cultural remains. Sealed beneath these deposits, Stratum IIA yielded a bifacially flaked “Mungai knife,” 6 large blades, 2 bifaces, a denticulate, and 104 waste flakes. Radiocarbon dates directly associated with the earliest artifacts were 16,175 years ago, 15,120 years ago, 14,925 years ago, 13,270 years ago, 13,240 years ago, and 12,800 years ago, all in proper stratigraphic order (Adovasio *et al.* 1977).

These dates have been questioned, based on the hypothesis that inactive carbon derived from vitrinized wood of Pennsylvanian age, carried as soluble humates in ground water, may have contaminated the C-14 samples to make them yield spuriously old dates. It has also been noted that the flora and fauna from Meadowcroft lacks Pleistocene species even though at the time indicated by the C-14 dates the Wisconsinan glacial front lay only about 160 kilometers to the north of the cave. Finally, it has been held that the lack of a distinctive stratigraphic break, within the 70 cm of deposits that should contain the transition between Pleistocene and Holocene times, implies that the sediments are misdated (Haynes 1980; Mead 1980; Kelly 1987).

The excavators have responded that the contamination theory is implausible in view of the many C-14 dates in proper stratigraphic order, and they observe that various laboratory tests of dating samples have been carried out, none of which showed any particulate or chemical contamination. They argue that the lack of arctic species in the Meadowcroft biota is a reflection of the site's southerly latitude and local microenvironmental conditions. Finally, they note that major roof-spalling episodes are in fact represented in Stratum IIa, dated between 12,800 and 11,300 years ago, that clearly mark the Pleistocene-Holocene boundary (Adovasio *et al.* 1980, 1982).

Of particular interest to the argument presented in this paper is the fact that the earliest Meadowcroft assemblage gives evidence of large Aurignacian-like blades and bifaces at dates very close to those predicted for the North American interior on the basis of early Asian and Alaskan evidence.

Fort Rock Cave, Oregon: Beneath a large spall fallen from the cave ceiling, a concentration of small charcoal flecks was observed in beach sands which lay on lake gravels from Pleistocene Lake Fort Rock. Nearby were found a much-resharpened bifacial stemmed point, a small lanceolate point, a grinding stone fragment, and a few flakes. The charcoal flecks, probably remnants of a hearth, yielded a C-14 date of 13,200 years ago (Bedwell 1973). The find is not, however, documented with detailed stratigraphic profiles or photographs, and the projectile points are typologically like those found at later dates. Thus it cannot be rigorously demonstrated that the artifacts and the C-14 date are properly associated, although the excavator of the site has stated his belief that they are (Bedwell 1973; Haynes 1971).

Wilson Butte Cave, Idaho: The site at Wilson Butte produced one medium-sized biface, 2 large blades, 2 bone objects, and a few waste flakes. Charcoal attributed to scattered hearths was found in the same stratum, as well as bones of horse, camel, sloth, pocket gopher, ground squirrel, and marten. A C-14 date of 14,500 years ago was obtained on a pooled sample of rodent bone. The stratum immediately below was dated to 15,000 years ago, also on bone (Gruhn 1965). The dates have been challenged, however, because they were run on bone rather than charcoal; a question has also been raised about possible rodent burrowing of the deposit, but it has been pointed out that the rodent bones actually found in the dated layer are not those of burrowing species. Finally, it has been suggested that some depositional events at the site would seem to have required more time, and others less time, than is indicated by C-14 dates from the deposits (Haynes 1971). Like Meadowcroft, Wilson Butte cave is of interest to the present discussion because it has produced large blades and a biface at a date that fits well with the Asian evidence.

Valsequillo, Puebla, Mexico: The Hueyatlaco locality at Valsequillo yielded an early complex buried from 2.2 to 2.6 meters below surface, in alluvial deposits (Irwin-Williams 1967). Recovered from the bottoms of a series of stream beds which cut through the deposits were edge-trimmed unifacial projectile points, scrapers, burins, perforators, and knives, all made on flakes and elongate blades reminiscent of Old World Upper Paleolithic specimens. The faunal assemblage from the gravels included mammoth, mastodon, horse, camel, giant ground sloth, dire wolf, and sabre-toothed cat. A C-14 date from the Caulapan locality, on shell associated with a crude scraper, was 21,850 years ago. At the El Horno locality, in the lowest part of the sequence, some 13 unmodified flakes were also associated with Pleistocene fauna. An estimated age of 250,000 years has been derived for the Hueyatlaco locality by measuring the amount of water trapped in volcanic glass shards from a tephra incorporated in the Hueyatlaco deposits. At the same locality, uranium-thorium dates of 245,000 and greater than 160,000 years have been derived from a camel pelvis said to have been associated with bifacial implements (Steen-McIntyre *et al.* 1981). The artifacts and fauna from Valsequillo are thus congruent in suggesting a Pleistocene age for a blade tool assemblage of Upper Paleolithic cast, but the available dates are wildly anomalous.

Taima-Taima, Venezuela: Bones of mastodon and large lanceolate biface points were found in a grey sand overlain by a series of clays, a context believed to represent an ancient spring. The mastodon bones show cut-marks that are thought to be evidence of butchering. Some 19 C-14 dates from the grey sand layer range between 14,440 years ago and 11,860 years ago, with one anomalous date of 7,590 years ago on mastodon bone. Three dates on mastodon bone (excluding the anomalous one) are 14,200 years ago, 13,880 years ago, and 12,980 years ago; finely chopped twigs, believed to be mastodon stomach contents, are dated to

13,000 years ago (Bryan *et al.* 1978). It has been pointed out, however, that the claimed association between the stone tools and the mastodon bones cannot be considered well demonstrated, because upswelling water in the ancient spring would have continuously reworked its sediments (Lynch 1990: 18).

Alice Boer Site, Brazil: From an alluvial deposit C-14 dated to 14,200 years ago were recovered a large contracting-stem point, 2 broken stems, a uniface, and a thick discoidal core/scraper. Below this level were found unifaces, fragmentary bifaces, a core, and a scraper made on what appears to be a thick flake blade. Details remain unavailable on the stratigraphic situation and the precise context of the C-14 date and artifacts. It has been noted that the contracting-stem projectile point type is known from significantly later contexts at other South American sites (Bryan and Beltrao 1978), and a recent review of the evidence from Alice Boer points out that the C-14 assay was run on an extremely diluted sample that would expectably have a large range of counting error (Lynch 1990:20).

Pikimachay Cave, Peru: In a highland cave near Ayacucho, uniface cobbles and flakes, and biface choppers, have been dated by one C-14 determination of 14,150 years ago on sloth bone. The specimens were accompanied by the bones of sloth, horse, deer, camelids, and smaller modern species. Claimed earlier artifacts dated between 15,000 and 20,000 years ago were nondescript specimens of the same soft stone that forms the walls of the cave, and lacked definitive marks of human workmanship (MacNeish 1978). A critical assessment of the evidence, however, casts doubt on the validity of the association between the stone tools and the dated sloth bone, suggesting that the specimens could easily have been intrusive from later overlying levels of the cave (Lynch 1990:25).

Monte Verde, Chile: The remains of five mastodons eroding out of a creek bank led archaeologists to a site which contained no bifacial projectile points, but did contain flakes, pebbles, and choppers, as well as perfectly shaped spherical stones. The site is waterlogged, and wood, seeds, pods, leaves, pollen, and flowers were preserved. Pieces of wood apparently shaped by cutting and scraping were also found, including one in which a sharp flake of stone was wedged. Poles and brush have been interpreted as representing a semicircular shelter. Associated evidence of burning in two places may indicate fire hearths. Bone, charcoal, and wood specimens were C-14 dated (using the 5730 year half-life) at 13,965 years ago, 13,030 years ago, 12,350 years ago, 12,115 years ago, 11,950 years ago, and 11,155 years ago. Despite the puzzling lack of well-formed stone tools at Monte Verde, its excavator believes that human presence is clearly indicated (Dillehay 1986). A more skeptical view, however, is that none of the specimens or features recovered clearly demonstrate the presence of human agency at the time indicated by the radiocarbon dates (Lynch 1990:26).

Los Toldos, Argentina: The lowest level of Los Toldos Cave #3, containing unifacially retouched flakes and camelid bones, has been C-14 dated to 12,600 years ago. Broad flakes and a few blade-like specimens, including one retouched as a projectile point, come from Level 11. In immediately overlying levels were found large blades and bifacial points of the Toldense industry, that has been compared with earliest Fells cave (Cardich *et al.* 1973). It appears from this evidence that the earliest occupation at Los Toldos immediately precedes the Magellan point, or Toldense industry, South American analogue of the Clovis Paleo-Indian culture. Indeed, Lynch (1990: 22–23) believes that the Level 11 materials from Los Toldos are not truly separable from the Toldense industry, but a part of it.

11 Conclusions

This review has summarized, from an intercontinental perspective, the major classes of archaeological evidence bearing on the question of first human entry into the Americas. The sites presented here are only examples among many that have been discussed in the scientific literature, but they include those yielding the best-controlled evidence so far available. As has been shown, extreme claims for human occupation of the Americas at a time range comparable to the Old World Lower and Middle Paleolithic are very poorly supported, but research on the topic continues to be pressed.

Much better evidence exists to show that cultures stemming from the Eurasian Upper Paleolithic were present in America. The large blade and biface technology known from Northeast Asia by about 25,000 to 18,000 years ago has clear analogues in both North and South American sites. This almost surely was the basic stone tool industry brought into the New World by the first Americans. Of critical importance, the microblade technology that began to appear in the far north shortly after 14,000 years ago is not represented in early Paleo-Indian sites of the American interior, and this implies that the first Americans had crossed Beringia and headed south before that time.

Some archaeologists hold that the fluted point horizon, represented by Clovis points in North America and Magellan points in South America, is the earliest well-demonstrated cultural manifestation in the western hemisphere, at a date of 11,500 to 11,000 years ago. It is true, and highly significant, that the fluted point period was characterized at least in part by a big game hunting way of life and a prepared core and blade technology very like that of far northeastern Asia. It seems beyond doubt that at bottom the fluted point cultures are traceable to the Northeast Asian tradition. Nevertheless, tantalizing evidence from both North and South America seems to indicate that fluted points themselves were not present in the earliest New World assemblages.

The evidence reviewed in this paper makes it seem quite likely that makers of large blade and biface tools first entered America two or three millennia before the time of the fluted point horizon, and that the distinctive practice of fluting projectile points only later arose and spread among their descendents. Granting that the earliest immigrants were few and that many generations would have to elapse before people and their artifactual leavings became reasonably numerous, the low archaeological visibility of this earliest non-fluted point stage of New World occupation is understandable.[3] At the time of writing it remains true that no fluted points have yet been found in Northeast Asia, further supporting the idea that these distinctive cultural markers were not in the baggage of the immigrant first Americans.

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[3] A recently reported analysis of mitochondrial DNA (mtDNA) sequence variation among the Pima of North America, Maya of Central America, and Ticuna of South America provides genetic evidence that the native New World population is derived from a very small number of founders. Four mtDNA haplotypes, derived from rare Asian mutations, are present at high frequencies in these widely dispersed American populations; this suggests that all American Indians may be derived from as few as four primary maternal lineages (Schurr *et al.* 1990). Independent clues from dental morphology, blood protein variation, and historical linguistics suggest that there may have been three founding populations (Greenberg *et al.* 1986).

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The Full-Glacial Ecosystem of Beringia

Charles E. Schweger

1 Introduction

The excavation a large mammoth tooth from frozen silt, peering through a microscope to discover fossil pollen or opening your mail to read a list of new radicarbon dates can create excitement, for it is collection and interpretation of such data that provides the basis for reconstructing the environments of the past. For ice-age Beringia the process of reconstruction began a century ago (Hibbert 1982), but accelerated greatly following the publication of the classic works by Colinvaux (1964), Hopkins (1967) and Guthrie (1968). The paleoenvironment of the Bering Land Bridge and unglaciated portions of Alaska and Yukon, refered to as Beringia, was portrayed as an arctic grassland or steppe populated by grazing animals and other diverse fauna while subjected to full-glacial climatic conditions. It was through this productive game-rich environment that late Pleistocene human populations were to have made their way from Asia to the New World.

This verdant picture was, however, challenged on a number of grounds by Cwynar and Rithchie (1980) and Ritchie and Cwynar (1982) who emphasized the limitations of pollen morphology and taxonomy and the strengths of the pollen influx method. They reconstructed the full glacial vegetation, represented by the herb zone in fossil pollen diagrams from the region, as a discontinuous tundra similar to that now found on dry, rocky sites above or beyond arctic treeline. To these authors (1982) "the 'arctic steppe biome' never existed in Beringia during the late Quaternary. [and] The large and diverse ungulate populations probably were present during Pleistocene interstadials . . . rather that during the time of the herb [pollen] zone, 30,000 to 14,000 years ago." Such a conclusion, which eventually came to be supported by Colinvaux (1980, 1981) and Colinvaux and West (1984), naturally stimulated considerable discussion and debate, especially as it jeopardized the full glacial land bridge as a human dispersal route to the New World.

The various points of view surrounding this issue were the focus of a 1979 Wenner-Gren Foundation Conference on the Paleoecology of Beringia and have been effectively presented in a book bearing the same title (Hopkins et al. 1982). Two dominant themes emerged from this work, firstly, the indentification and use of modern analogues in reconstructing Beringia; and secondly, the apparent contradiction offered by the presence of the diverse grazing fauna under full-glacial conditions in an environment that is now boreal forest and seemingly incapable of supporting such a fauna, thus creating a "productivity paradox" (Schweger et al. 1982). Both of these issues were systematically readdressed in Guthrie's (1984) critical response to Ritchie, Cwynar, Colinvaux and West. The fossil pollen influx data and radiocarbon record of fossil vertebrates is reinterpreted by Guthrie who builds a case for an Eurasian mammoth-steppe, that has no modern analog, and was characterized by a continuous and coherent fauna that persisted through the last glacial.

Guthrie has continued to explore the vertebrate paleoecology of Beringia (1985), most recently (1989) describing "Blue Babe" the well preserved bison carcass recovered from the Alaskan permafrost, now on display in the University of Alaska Museum. Further contributions to the vertebrate record have been made by Harington (1978, 1981) and Porter (1988). The vegetation history of Beringia, largely emphasizing fossil pollen research, is well covered in the following research publications: Ager (1983), Ager and Brubaker (1985), Anderson et al. (1988); Brubaker et al. (1983); Cwynar (1982); Edwards and Brubaker (1985); Edwards and Brubaker (1986); Heusser (1983); Lamb and Edwards (1988); and Ritchie (1982, 1984, 1987). These papers present results that are methodologically sound, largely free of uncritical speculation and that have made use of recent paleoclimatic modelling experiments (Barnosky et al. 1987). The work of Soviet colleagues researching the late Quaternary environments of western Beringia or Siberia has too often been overlooked by North American researchers because of the language barrier. The fine review edited by Velichko (1984) and published in English is a welcome and useful addition to the literature.

Unfortunately, there have been too few brave efforts to integrate the various aspects of the Beringian paleoenvironment into a "whole" that might be of particular use to those concerned with the human occupation of northwest Asia and Beringia. Perhaps the earlier bout of controversary chastened such attempts, or perhaps too little attention has been paid to developing research methodologies that are more than "scenario building."

In this regard much remains yet to be accomplished.

2 The Beringian Ecosystem Model

Quaternary paleoecology has been undergoing an important methodolgical advance with the growing recognition of the need to test hypotheses generated from appropriate dynamic models (Birks 1985). A simplified ecosystem model applied to the unglaciated portions of Alaska (Hamilton and Thorson 1983) and Yukon (Hughes 1987) for the interval of the last glaciation, 30,000 to 13,000 B.P. (Barnosky et al. 1987; Matthews et al. 1990) will serve to organize the diverse data and aid interpretations and the generation of testable hypotheses. The qualitative ecosystem model presented here consists of seven components and all probable interactions (Fig. 1). What follows will be a generalized description of the Beringian ecosystem, as I reconstruct it drawing on a wide variety of sources and interpretations, a brief examination of how it might have functioned, and an example of how one might use the model to direct research into the dynamic aspects of paleoecology.

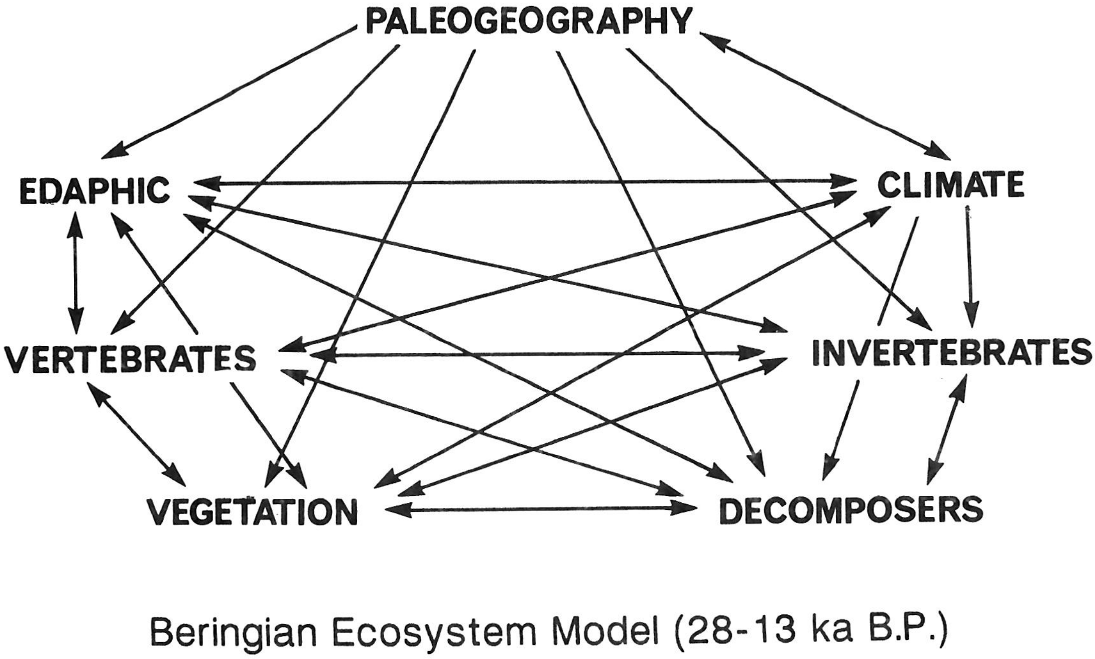

Figure 1. Diagram of the seven components and their interactions that make up the Beringian ecosystem model.

Paleogeography

The onset of climatic changes 30,000 years ago initiated the buildup of glacial ice on continents, leading in turn to a 100–120 m drop in sea level. Much of the Chukchi and Bering marine shelves were exposed forming a 2000 km wide land bridge linking northeast Asia (Chukotka) to northwest North America (Alaska). Limited in the Yukon by Cordilleran and Laurentide glacial ice, Beringia was in reality the eastern most province of the continuous mammoth-steppe biome (life zone) that extended out of unglaciated northeastern Siberia. The Arctic Ocean remained largely ice covered, while shore-fast and seasonal sea ice extended off the Bering Sea coast (Sancetta 1983) and extensive glaciers and ice caps in the Alaska and St. Elias Ranges intercepted moisture from the Gulf of Alaska.

Climate

This paleogeography effectively eliminated or displaced moisture sources away from interior Beringia resulting in great aridity. Climatic modelling indicates that at the height of the last glacial, 18,000 B.P., Alaska came under strong anticyclonic circulation, adiabatic warming of air flowing down off the ice sheets and a generally southerly flow associated with a northern branch of a split jet stream. This resulted in January temperatures that were warmer than at present (Kutzbach 1987). In July, however, at the height of the arctic growing season the temperatures were cooler than at present.

The arid, continental and windy glacial climate of Beringia greatly influenced all other components of the ecosystem. For example, a thin or patchy snow cover enabled those mammals lacking specialized “cratering” adaptations, such as tusks, antler brow-tines, densely haired snouts or pawing behaviour, to reach winter fodder with minimum caloric expenditure. This accounts for the dispersal into Beringia of the Saiga antelope, a mammal of the Asian steppe now limited to regions with less than 10–20 cm winter snow depth. With less snow to be melted a higher proportion of the spring-early summer solar radiation was directly utilized in the “greening-up” of the tundra and in subsequent plant growth. Beringia’s high latitude position and clear cloudless skies resulted in high summer values of solar radiation. The coincidence of peak radiation with peak plant production implies relatively high early summer primary production, providing of course that sufficient moisture was locally available.

Many ecosystem interactions led to important positive “feed-backs.” Cratering by grazing animals, for example, roughened the snow surface and exposed patches of bare ground, thereby significantly altering the albedo or reflectivity of the snow surface. The reduced albedo hastened snowmelt and the early onset of spring. In this way, and others, grazing animals had an effect on their environment that was ultimately beneficial to the animals themselves.

Vegetation

Due to cold and aridity the vegetation of Beringia was treeless and open, displaying both tundra and steppe affinities, with *Salix* (willow) the dominant shrub along streams and flood plains. Shrub *Betula* (birch) and *Populus* (poplar or aspen) may have been present in the most favorable settings. Some taxa, such as ericaceous species or *Sphagnum* moss, that are now widely abundant, were rare or absent; other taxa such as *Chenopodium* or *Artemisia* may have been more widespread and locally abundant. At higher elevations or where coarse stony soils existed cushion plant-fell field tundra was present, and in moist lowlands or along stream courses where permafrost was absent herbaceous and sedge meadows dominated.

In northwestern Alaska such meadows may have approximated a complete vegetation cover with productivity, at least as measured by pollen accumulation rates (number of grains/cm^2/yr), approaching that of modern northern grasslands (Manitoba, Canada) (Anderson 1988). The vegetation cover of Beringia was a mosaic of plant communities controlled by the important ecological gradients of slope, aspect, elevation, drainage and moisture and environmental perturbations. Such a pattern provided the diverse habitats required by the variety of vertebrate animals, but it also means that at some scale terms such as "grass-land" or "tundra" lose their descriptive value. As aridity was a dominant factor, the term tundra or arctic "steppe" is frequently employed for general description.

Vertebrates

Small mammal assemblages from central Alaska were dominated by *Microtus gregalis* (meadow vole), *M. miurus* (singing vole) and the widespread *Spermophilus parryi* and *S. undulatus* (Arctic ground squirrels) all of which utilized the then more widely available well drained substrate (Guthrie 1982). The large mammal herbivore fauna was dominated by Bison priscus, Mammuthus primigenius (woolly mammoth) and *Equus* (various species of horse and ass), along with *Rangifera* (caribou), *Cervus* (stag), *Alces* (moose), *Camelops* (camel), *Saiga* (saiga), *Ovis* (mountain sheep) and the musk oxen *Ovibos, Symbos* and *Bootherium.*

There were predators in the form of *Felis atrox* (lion), *Arctodus* (short faced bear), foxes (*Alopex* and *Vulpes*) and possibly wolf. The diversity and the fact that most of the herbivores displayed some herd behaviour probably indicates an increase in mammalian biomass over present values.

Besides cratering, Beringian mammals affected their environments in several other ways. Cropping of vegetation changed its composition and structure (Redmann 1982) and may have actually enhanced its productivity (Detling 1988). Certainly the effects of trampling and manuring would have stimulated growth and increased nutrient turnover, as they do today in the meadows on Ellesmere Island, Canadian High Arctic, grazed by musk oxen (Henry and Svoboda 1987).

The cycling of nutrients (e.g. K, Ca, Mg, phosphates and nitrates) from the soil-to plant-to animal-to decomposers-back to soil was very rapid and efficient. Modern Eurasian steppe environments are able through rapid nutrient turnover to maintain high vertebrate biomass production on limited plant biomass (Dolukhanov and Khotinskiy 1984). Such was no doubt the situation in Beringia as well.

Decomposers and Invertebrates

Feces were initially broken down by the abundant dung beetle, *Aphodius*. One can infer, partly because of the lack of peat from full glacial times, that bacterial and fungal decomposition was also rapid in furthering the return of nutrients to the soil.

The full range of invertebrates in Beringia is poorly known, the exception being insects, especially Coleoptera or beetles and weevils. Many of these, such as members of the Crybius group, represent tundra, those of the Lepidophorus-Morychus group indicate dry sites, xeric tundra and grasslands, even saline substrates (Matthews 1982).

3 The Edaphic Component (Full Glacial Soils)

It is appropriate that extra attention be given to the Edaphic component of the ecosystem since it is through the soil that we see the integration of so many physical, chemical, biological and climatic factors, and it is with the soil that one must first approach the issue of productivity. The soils of Beringia were warm, well drained and vegetated by deeply rooted tundra and steppe species including grasses, *Artemisia, Polygonum, Chenopodium* and *Plantago*, all known from fossil records. Organic litter was minimal and bare mineral soil was often exposed. Microbial activity was high, the pH was high, and salts may have often accumulated at the soil surface due to evaporation. This soil had a high nutrient status and was capable of supporting the Beringian ecosystem. Under the Canadian soil classification system (Canadian Dept. of Agriculture 1970) such a soil would be classified as a Rego Brown Soil.

It may be informative to contrast the glacial Rego Brown Soil with a Cryosol (Canadian Dept. of Agriculture 1970), typical of so much of the present-day surface of Alaska and Yukon (Fig. 2). Cryosols are cold, poorly drained and characterized by a vegetation of moss and ericaceous species and the tussock forms of *Eriophorum*. These soils are generally acid and display very low nutrient status, with most of the nutrients locked up in peat or the permafrost. The insulative nature of the accretionary surface organic layer, due in part to low levels of mircobial decomposition, maintains the shallow permafrost table.

A key difference between these two soils was the incremental deposition of eolian silt or loess to the glacial Rego Brown Soil surface. It is hypothesized that the deposition of loess under full glacial conditions was a key factor in maintaining the highly productive Rego Brown Soil and, ultimately, the Beringian ecosystem.

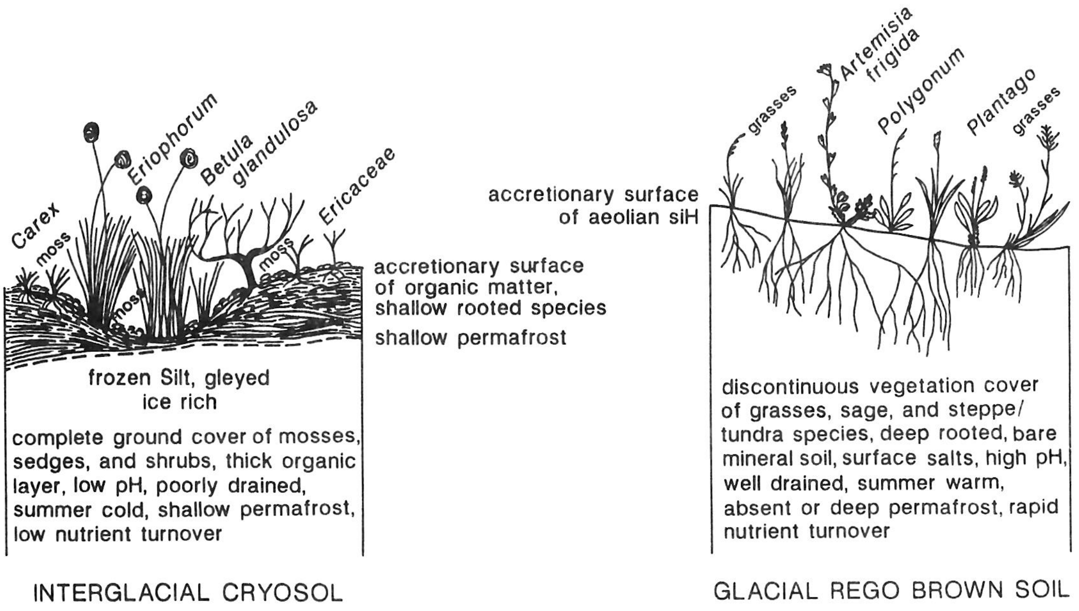
Carex
moss
Eriophorum
Betula glandulosa
Ericaceae
moss
moss
accretionary surface of organic matter, shallow rooted species
shallow permafrost
frozen Silt, gleyed ice rich
complete ground cover of mosses, sedges, and shrubs, thick organic layer, low pH, poorly drained, summer cold, shallow permafrost, low nutrient turnover
INTERGLACIAL CRYOSOL
accretionary surface of aeolian silt
grasses
Artemisia frigida
Polygonum
Plantago
grasses
discontinuous vegetation cover of grasses, sage, and steppe/ tundra species, deep rooted, bare mineral soil, surface salts, high pH, well drained, summer warm, absent or deep permafrost, rapid nutrient turnover
GLACIAL REGO BROWN SOIL

Figure 2. Hypothetical soil profiles contrasting interglacial and glacial edaphic conditions.

4 Testing The Loessal Hypothesis

In order to test hypotheses generated from a model, such as the ecosystem model presented here, one cannot employ the same data used in constructing the model as this would introduce an undesirable circularity. Since, to my knowledge, no paleosol from full glacial Beringia has ever been described the hypothesis regarding the role of loess must be tested through the use of analogues (Birks 1985). Three recent discoveries support the hypothesis that loess was a key factor in soil formation and maintenance of the Beringian ecosystem. Firstly, studies of road dust accumulations in northern Alaska simulate the effects of loess fall on typical forest-tundra vegetation. The changes in plant community composition, noted by the elimination of *Sphagnum* moss and ericaceous species and the appearance of species that are suited to mineral substrates, deeper thaw, higher pH, and more rapid snow melt (Walker and Everett 1987) are quickly moving the environment towards that which has been hypothesized for the Rego Brown Soil. Secondly, a recent survey of grazing potential in southern Yukon discovered high forage production and greatest carrying capacity, at least for horses, in grassland/parkland communities dominated by *Artemisia-Festuca*. Such communities and their distinctive high pH, high $CaCO_3$, well drained loamy soils were "limited to those areas located close to a source of windblown loess such as the Donjek River" (Johansen et al. 1989). Thirdly, geochemical analyses of Antarctic glacial ice has led to the discovery of substantial concentrations of nitrate and lesser amounts of ammonium ion. Zeller et al. (1988) conclude that glacial ice can act as an atmospheric sink for these nutrients and that ice marginal environments watered by glacial melt waters would be highly productive. To carry their point a bit further, such melt waters rich in potassium, phosphate and fixed nitogen would also contain rock-flour derived from glacial abrasion, this being the source of the potassium and phosphate. These highly reactive fine particules (<0.001–0.1mm) could possibly adsorb the nitrates and upon redeposition as loess fertilize great areas often at considerable distance from the ice margin itself.

Late Pleistocene loess derived from the last period of glaciation is widespread in Yukon, Alaska (Pewe 1983), the Soviet Union (Velichko et al. 1984) and large parts of Europe (Flint 1971). Palynological studies indicate the presence at the same time of regional mixtures of tundra, desert, steppe and forest-steppe environments from eastern Siberia, through to the eastern European plain and into western Europe (Frenzel

1973; Grichuk 1984). These lands were characterized by a fauna that, with some exceptions such as the wooly rhinoceros (*Coelodonta antiquitatis*), was remarkably similar to that recovered from Beringia (Kurten 1968; Markova 1984; Vereshchagin and Baryshnikov 1982; Vereshchagin and Kuz'mina 1984). Similarities in the broad regional patterns of vegetation, fauna and loess deposition suggests similarities in ecological processes over this region and supports the concept of the late Pleistocene "mammoth-steppe biome" (Guthrie 1982).

Greenland ice core evidence points to high levels of eolian dust throughout the last glacial at high latitudes (Hammer et al. 1985). The rapid decline in the dust content of the ice at 13,000 B.P. marks the end of the last glacial, the beginning of the Birch Period in Beringia (Lamb and Edwards 1988) and the end of this unique environment (Guthrie 1985). Such coincidences support the hypothesis presented here, that loess deposition was an important and necessary component of the Beringian ecosystem and by extention the mammoth-steppe biome. The cessation of the loess fall, due to glacier retreat and the vegetation of unstable surfaces, marked the end of this unique biome. [I follow Matthews (1982) and Guthrie (1984) in concluding that the extinction of the Pleistocene large mammal assemblage rules out the possibilities of modern analogues, although some local environments such as the grazed loessal grasslands of southern Yukon may be close approximations.]

5 Future Research

Recent novels and even Hollywood-style films featuring late Pleistocene adventures and leather-clad cave women provide images that hold our interest and stimulate the imagination. The reconstruction of the ice-age environments of Beringia requires, however, much more than vivid images. Great progress has been made in the techniques and methodology of Quaternary paleoecology and the level of sophistication achieved in reconstructing vegetation and climate for some intensively studied regions is truly impressive (Huntley 1988). Of particular importance has been the development of computer-based global climatic models with the capability of predicting atmospheric circulation, surface winds, precipitation, evaporation and temperatures for different boundary conditions and for different time periods of the past. Variations in insolation due to perturbations in the earth's orbit have been modelled and provide the impetus for large-scale climatic changes (Kutzbach and Guetter 1986), while sufficient resolution has been achieved so that such models can now be applied to regions as “small” as Beringia (Barnosky et al. 1987). We should anticipate further developments in paleoclimatic modelling and it is, therefore, important that researchers working in Beringia keep abreast of such developments, although the lack of well-studied sites and the sheer size of the region will result in slower progress.

Paleoenvironmental methods have achieved great variety and each method records or senses the past environment in different ways and at different spatial and temporal scales (Jacobson 1988; Prentice 1988). Pollen analysis, for example, can be carried out on large and small lakes, peat, alluvium, cave fill, or frozen stomach contents with somewhat different results in each case; used together they can provide a sensitive record of the paleoenvironment. An awareness among researchers of the strengths and limitations of each method will lead to more sophisticated research strategies whereby a variety of paleoenvironmental techniques and methods will be used in concert by multidisciplinary and no doubt multinational research teams. Although there has been a growing appreciation of how taphonomic factors affect the recovery and interpretation of animal as well as plant fossil remains, further documentation of these factors must be undertaen in order to assure realistic conclusions.

Paleoecology has been and will continue to be, at least in part, a historical discipline. However, as with other historical disciplines it is inevitable that there will be a methodological shift, in this case towards the exploration of the dynamic ecological properties of past environments. Birks (1985) describes this ecological approach to paleoecology as one “that attempts to test ecological hypotheses in time rather than space” and one that inevitably becomes quantitative requiring large data sets and multivariate analysis. Bliss and Richards (1982) have presented a trophic or maximum carrying capacity model for Beringia that is clearly a pioneering effort in this direction. Their quantitative analysis indicates that a band-sized group (15–20) of humans could have occupied a 1000 km^2 region of Beringia while hunting large Pleistocene mammals, including mammoth. In this presentation, I have attempted to provide a generalized and qualitative example of this approach in identifying and testing the role of loess. Certainly, a large number of hypthoses can be generated and tested regarding loess, its generation, chemistry, transport, distribution, pedogenesis and role in the evolution and functioning of the mammoth-steppe biome, and this is only one factor or component of the complex ecosystem. At this point in time we are probably more limited by our lack of models and hypotheses applied to Beringia than we are by the lack of study sites and techniques.

The Mongoloid Dispersal Project acknowledges the critical role that Beringia and the mammoth-steppe played in the evolution, adaptation and movement of Mongoloid populations. It signals that these are issues of international status that require cooperative international research programs. The organizers of this Project have truly displayed a unique vision.

The record of hominid evolution can now be extended three or four million years back into Africa. From this perspective the mammoth-steppe biome of Beringia existed and ceased to exist only "yesterday," but as scholars, researchers and members of an interested public it will continue to hold our fascination for a long time in the future.

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The Peoples of Eastern Beringia

W. R. Powers

In keeping with the theme of the conference, I will address the archaeological evidence from Alaska and the neighboring regions of northeastern Siberia that, in my opinion, reflect the dispersal of populations from Asia to North America over the last 14,000 years B.P. At the present time, I can detect three major archaeological traditions which resulted from Asian population movements into Beringia and northern North America: the Paleoindian Tradition, the Paleoarctic Tradition and the Arctic Small Tool Tradition.

1 The Paleoindian Tradition

There is only scant evidence that humans had occupied eastern Beringia prior to 12,000 years B.P. Whereas many archaeologists have previously accepted the evidence from the Trail Creek Caves on the Seward Peninsula as indicating human presence between 13,000 and 16,000 years B.P. (Larsen 1968), recent research has shown that the bone materials thought to have been humanly altered could be explained by natural means (Guthrie 1985; Vinson 1988), and the dog teeth reported from the caves (Larsen 1968) have been identified as deciduous bear teeth (Dixon and Smith 1986).

The earliest evidence for human occupation of eastern Beringia is from the Blue Fish Caves in the Yukon Territory of Canada (Morlan and Cinq-Mars 1982). Here, chipped stone tools have been dated to between 12,900 ± 100 and 15,500 ± 150 years B.P. Unfortunately, further conclusions are prevented by the tiny sample of tools from the cave.

Although it almost certain that human groups were inhabitating eastern Beringia in the 13th to 15th millennia B.P., the oldest large, diagnostic assemblages derive from the Nenana Valley of central Alaska and date to the 12th millennium B.P. (Powers and Hoffecker 1989).

The oldest archaeological assemblages in the Nenana Valley are called the Nenana Complex (Figs. 1 and 2). This complex is best known from two excavated sites: Dry Creek (Component I) and Walker Road (Component I) located just north of the central portion of the Alaska Range. In addition, the Nenana Complex has been isolated through test excavations at the Moose Creek site north of Walker Road (Hoffecker 1985) and at the Owl Ridge site to the west in the nearby Teklanika River Valley (Phippen 1988). At all sites, artifacts of the Nenana Complex lie near the base of stratified aeolian deposits (loess and sand) which vary from 1 to 2 meters in thickness. While these aeolian deposits cover the glacial outwash terraces which flank the Nenana Valley, they are thickest on the Healy Terrace (Early Wisconsinan or Illinoisian) which is the second major terrace of the valley. The archaeological sites containing the Nenana Complex lie at an elevation of about 100 meters above the Nenana River on the Healy Terrace at prominent headland promontories formed by the incision of tributary streams cutting down through the outwash deposits. The sites are situated on the north side of the tributary streams and face south.

Carbon 14 dating (both conventional and AMS) and thermoluminesence dating were employed to establish geochronological control over the Nenana Complex. This complex is dated to 11,120 ± 85 (SI-2880 [conventional C14-charcoal]) and 11,350 ± 1000 (TL-loess) years B.P. at the Dry Creek Site. At the Walker Road Site the Nenana Complex is dated to 11,820 ± 200 (Beta 11254 [conventional C14-charcoal]) and 11,110 ± 230, 11,170 ± 180 and 11,300 ± 120 (AA-1683, 1681 and 2264 [AMS C14-charcoal]) (Powers and Hoffecker 1989; Goebel et al. 1990). A single date from the Owl Ridge site on the Teklanika River of 11,340 ± 150 (Beta-11209 [conventional C14-charcoal]) applies to the basal silt containing the Nenana Complex. Conventional C-14 dates run on soil organics from the lower pedocomplex overlying the Nenana Complex at the Moose Creek Site in the Nenana Valley are also pertinent: 8,160 ±160 (A-2168), 8,940 ± 270 (A-2144), 10,640 ± 280 (I-11227) and 11,730 ± 250 (GX-6281). Thus, our oldest archaeological horizon falls in the first half of the 12th millennium B.P. and may extend into the second half of the same (Powers and Hoffecker 1989). Furthermore, the Nenana Complex is coeval with the Clovis Culture (Llano Complex) of the North American Great Plains.

We have little information at our disposal on the paleoecology of the Nenana hunters. At the present time, Component I (Nenana Complex) and Component II (Denali Complex) at the Dry Creek site contain the only association of Pleistocene mammals and artifacts in Alaska. The

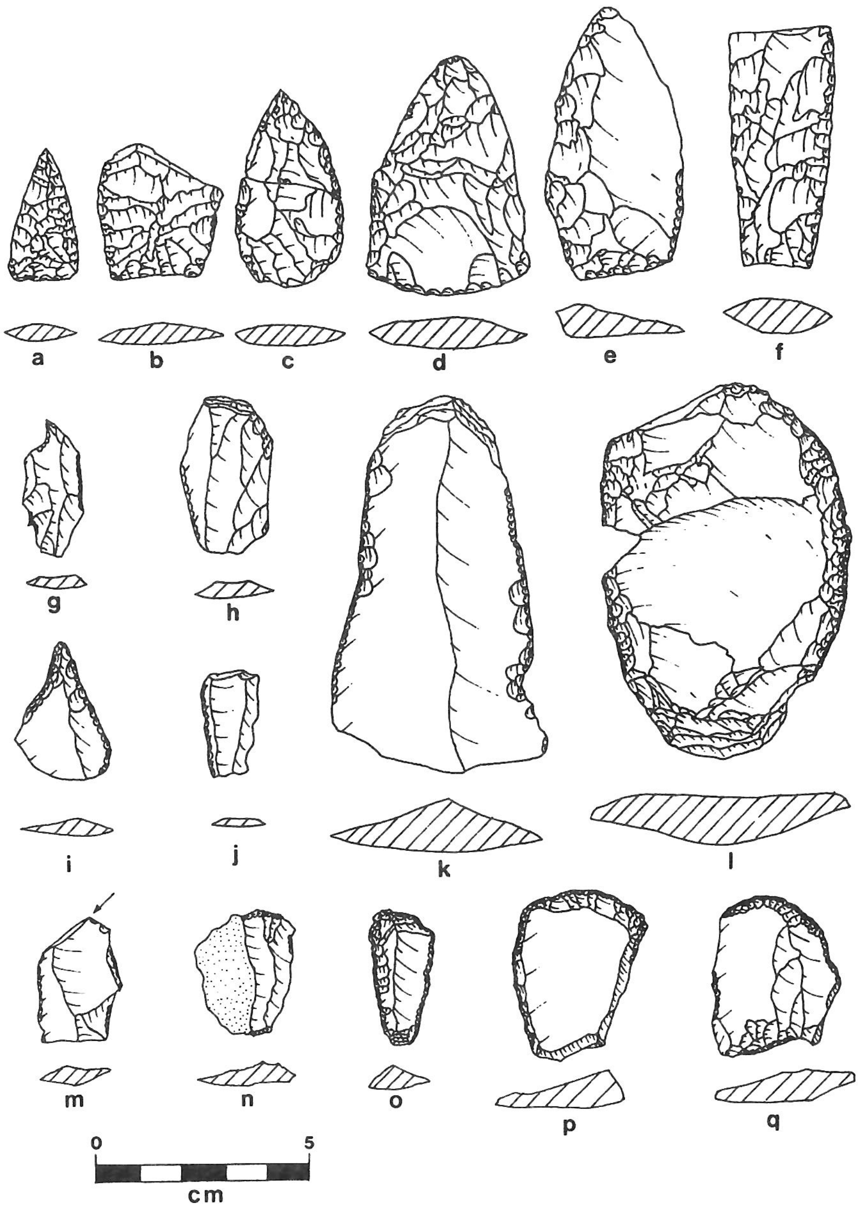

Figure 1. Nenana Complex Artifacts

a. Small triangular point, Dry Creek
b. Lanceolate point fragment, Moose Creek
c. Chindadn point, Walker Road
d. Large triangular point, Dry Creek
e. Lanceolate point, Dry Creek
f. Lanceolate point, Moose Creek
g. Perforator, Walker Road
h. Utilized bladelet, Walker Road
i. Bifacially worked perforator, Walker Road
j. Utilized bladelet, Walker Road
k. Utilized blade, Walker Road
1. Double convex side scraper, Walker Road
m. Dihedral burin, Walker Road
n. Wedge-like object
o. End scraper on a blade, Walker Road
p. End scraper on a blade, Dry Creek
q. End scraper on a flake, Walker Road

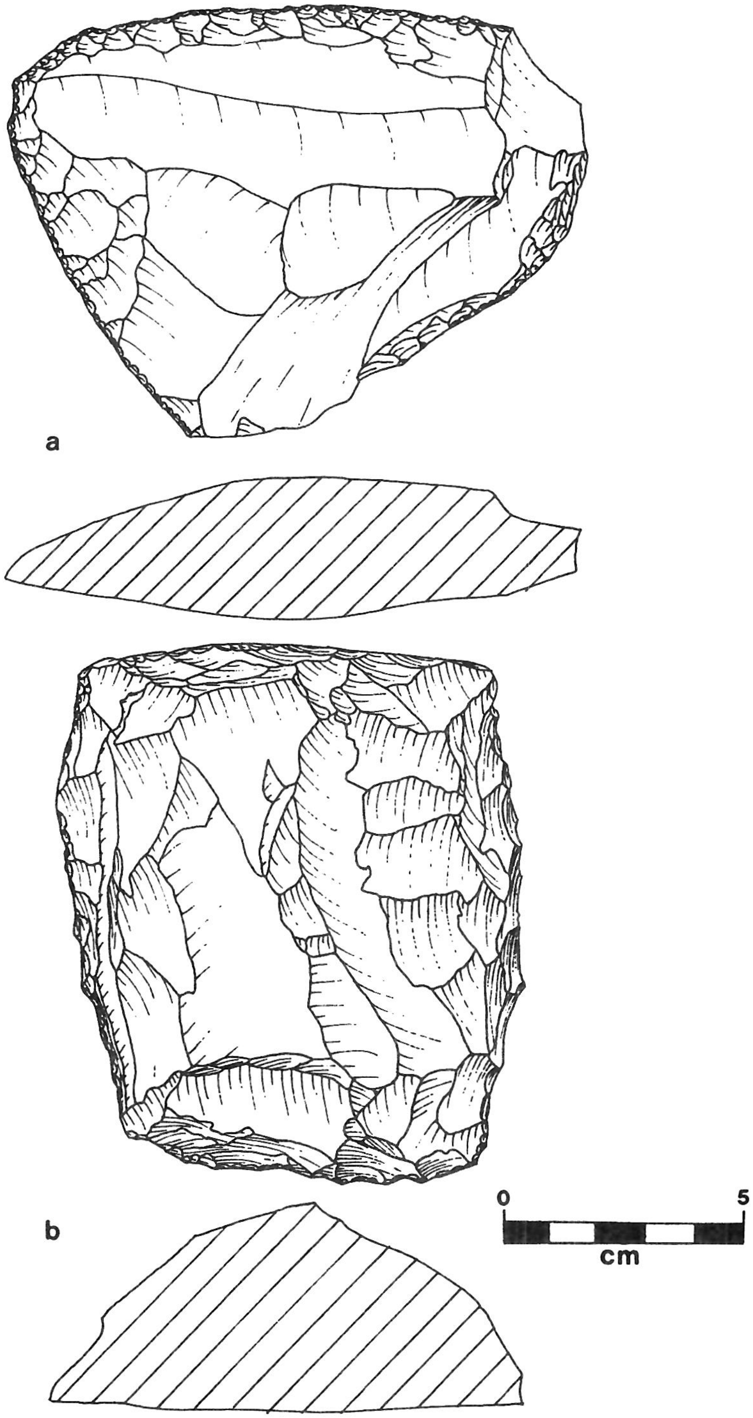

Figure 2. Nenana Complex Artifacts

a. Angle (Dejete) scraper
b. Quadrilaterally worked plano-convex tool

poorly preserved teeth of Dall Sheep (*Ovis dalli*) and wapiti (*Cervus canadensis*) were found with the Nenana Complex. Dentition of Dall Sheep and Bison (*Bison priscus*), in the same poor state of preservation, occurred with the Denali Complex. Stratigraphically, the Nenana Complex lies in a basal loess layer which is overlain by a stratum of sand of variable thickness. At Dry Creek, the age of this sand falls between 11,120 ± 85 and 10,690 ± 250 (SI-1561). This sand possibly records a sharp climatic deterioration correlative with the Younger Dryas of Northern Europe (Bigelow et al. n.d.), and if so, the Nenana people occupied the northern foothills of the Alaska Range during a interstade just preceding a local equivalent of the cold Younger Dryas stade.

The Nenana Complex is known only from lithic remains and the few bone remains mentioned above (Figs. 1 and 2). The absence of microblades, microblade cores or microcore debitage in the Nenana Complex is noteworthy. Rather, this complex is characterized by broad blades detached from single platform cores with one removal face and a tool kit comprised of end scrapers, side scrapers, wedges (*piece esquilles*), perforators (gravers), bifacial knives, bifacial points, and large cobble tools which sometimes resemble planes. The bifacial points can be further classified into the following three forms: 1) small and large triangular with slightly convex to straight bases, 2) lanceolate with slightly concave bases, and 3) large and small tear-drop shaped Chindadn points. Chindadn points were first found at Healy Lake (Cook 1969) and are the oldest points in the Tanana Valley.

The only information on site organization was uncovered at Walker Road. Three clusters of cultural debris were found along the bluff edge. Two clusters about 5 m in diameter each were associated with hearths, while the third, about 1.5 m in diameter, represents a single flaking event. The most important of the three is the 5 m cluster situated 10 m north of the bluff edge. This cluster is circular with a centrally positioned hearth which had been excavated into the gravel at the base of the loess and which contained red ocher, charcoal and bone fragments. About 150 tools and 2000 flakes were recovered in this cluster. The circular distribution of flakes and tools suggests the presence of a skin tent structure.

With the exception of the different point forms, the Nenana Complex tool kit is typologically similar to the Clovis tool kit. This similarity has led us to the conclusion (Goebel et al. 1990) that the two complexes are probably related by common ancestry and represent the northern and southern variants of an undiscovered archaeological counterpart of a peopling event called "Macro-Indian" (Turner 1984, 1985, 1986; Greenberg et al. 1986).

Just when this event occurred is still an open question but it certainly predates 12,000 years B.P. although no exact counterpart of the Nenana Complex, or Clovis, can be found in assemblages belonging to the Siberian Late Upper Palaeolithic (ca. 10,000–20,000 years B.P.). While Mochanov (1977) found one triangular point/knife with a slightly concave base at Diuktai Cave on the Aldan River, the total assemblage from that site, along with all Diuktai Culture sites dating after 20,000 years B.P. point to affinities with the Denali Complex of Alaska which replaces the Nenana Complex in the Nenana Valley after 11,000 years B.P. Also, the materials from layer VII at Ushki Lake, Kamchatka (Dikov 1979; Dikov and Titov 1984) are reminiscent of the Nenana Complex in general but the points types are entirely different. Cultural materials from Berelekh, northeastern Siberia (Mochanov 1977) are of the right age for the ancestral culture and display evidence of a bifacial point technology although the reported presence of a microblade technology would align this assemblage with the Diuktai Culture.

If we were to argue for a peopling event at about 12,000 years B.P. that would bring the ancestral culture into Alaska from Asia, we would have to propose that bifacial points and not microblades dominated the Beringian lithic industries, and that Ushki Lake level VII and the Nenana Complex might represent the early and late phases of bifacial point development. We should also note that bifacial points were established in Japan by 14,000 B.P. and that there microblade complexes appear to be younger (Aikens and Higuchi 1982; Ikawa-Smith 1978), a situation comparable to Kamchatka and Alaska. In this scenario, Clovis, by virtue of its overall technological/typological similarity, could have been derived from this point tradition (Powers and Hoffecker 1989; Dikov 1979; Haynes 1982). To test this theory we simply have to produce stratigraphic and chronometric evidence of Clovis points in Beringia that are about 12,000 years old. Furthermore, there should be evidence that the development of Clovis points affected northeast Asian point technologies. For the present, such evidence is unconvincing and we must conclude that the development of Clovis points was in isolation from the Eurasian Upper Palaeolithic (Goebel et al. 1990).

The origins of the culture ancestral to both Clovis and the Nenana may lie much further back in the Siberian Upper Palaeolithic. Both the Nenana Complex and Clovis share blades and blade tools and we assume that this characteristic derives from the ancestral culture. Since the transition to the Upper Palaeolithic in Siberia occurred about 35,000 years B.P. (Larichev et al. 1988) the formation of the ancestral culture must have happened after that date. Bifacial knives began to appear in the Siberian blade industries about 24,000–25,000 years B.P. (Vasil'evskii et al. 1988). Furthermore, microblades and microcores are unknown in the Nenana Complex and all Paleoindian tool kits. Hence, we would argue that the ancestral culture had no knowledge of microblade technology. From these observations, we would argue that the peopling event ancestral to the American Paleoindians occurred after the addition of bifacial tools to the tool kit and before the widespread adoption of microblade technology and the composite inset technique at about 18,000 B.P. The ancestral culture could have settled in Beringia between 18,000 and 25,000 B.P. but probably before the maximum of the Sartan/Late Wisconsinan Glaciation so that the easternmost branch of the culture could have moved south prior to the closing of the ice-free corridor (Goebel et al. 1990).

Evidence that the theoretical ancestral culture is real has been uncovered at the Ust'-Kova site in the northern Angara region of eastern Siberia (Vasil'evskii et al. 1988). The middle complex at this site has been C-14 dated to 23,920 ± 310 years B.P. (KRIL-381) and contains bifacial knives, but no points, planes, the prismatic blade technique and tools made on blades: retouched blades, end scrapers, perforators (gravers) and wedges (piece esquilles). This type of industry is perfectly positioned both technologically and chronologically to have been involved in the formation of the ancestral Paleoindian culture (Goebel et al. 1990).

2 The Paleoarctic Tradition

We are on much firmer ground in assessing the Asian affinities of assemblages which follow the Nenana Complex. About 10,500 to 11,000 years B.P. a late derivative of the Diuktai Culture occupied Beringia. The oldest evidence of this occupation derives from Kamchatka where it was called the Late Ushki Upper Palaeolithic Culture and dated to 10,760 ± 110 B.P. and 10,360 ± 350 B.P. (Dikov 1979). In Alaska, the oldest occurrence of this occupation is Component II of the Dry Creek site dated to 10,690 ± 250 (SI-1561) which is an assemblage nearly identical to the Late Ushki Upper Palaeolithic (Dikov 1979; Powers and Hoffecker 1989). In the Alaskan interior assemblages comparable to Dry Creek Component II are called the Denali Complex specifically (West 1967) or have been referred to the American Paleoarctic Tradition in general (Anderson 1968). These Alaskan assemblages along with their Siberian counterparts, including the Diuktai Culture, have been subsumed under the term Siberian-American Paleoarctic Tradition (Dumond 1977) or Beringian Tradition (West 1981). However, the latter, broad usage may obscure meaningful differences in the assemblages, particularly between northern and southern Alaska.

For the present, there appear to be two variants of the American Paleoarctic Tradition: southern and northern.

In the Alaskan interior the southern variant, known locally as the Denali Complex, dates to between 10,600 and 7000 years B.P. In the Nenana Valley it is known from Dry Creek (Component II) (Powers and Hamilton 1978; Powers et al. 1983) and Panguingue Creek (Component II) (Powers et al. 1983; Powers and Maxwell 1986). Other possible manifestations have appeared at the Usibelli site and Slate Creek (Hoffecker 1985).

Denali assemblages also occur at other interior localities: the Teklanika River sites (West 1967), Donnelly Ridge (Delta River) (West 1967) and the Tangle Lakes area (in particular, Mount Hayes 111) (West 1975), the Campus site (Fairbanks) (Nelson 1937; Rainey 1940; West 1967) and at Healy Lake (Cook 1969).

A peculiar feature of the Denali Complex in the Alaskan interior is its disappearance for several thousand years during the Northern Archaic Period only to reappear about 2000 years B.P., e.g., at Healy Lake (Cook 1969) and in the Nenana Valley at Little Panguingue Creek (Powers and Hoffecker 1989) as well as at other interior sites where it has been called Late Denali (Dixon 1985). This problem is unresolved and lies beyond the scope and purpose of this paper.

Bluff edge promontories remained popular with the Denali hunters especially in the Nenana Valley and at the Campus site. At the Dry Creek site, spatial studies revealed 14 separate activity clusters measuring between 2 and 4 m in diameter which differed in terms of raw materials, debitage and tools. In general, projectile point fragments were found segregated from clusters containing microblades, microcores and microcore debitage. No obvious hearths were found although each cluster is associated with charcoal spots and stains, which are the possible remains of former hearths (Powers and Hoffecker 1989).

Again, the only information of the hunting activities of the Denali people was found at Dry Creek. Component II contained poorly preserved faunal remains of Dall Sheep (*Ovis dalli*) and steppe bison (*Bison priscus*) (Powers and Hoffecker 1989). Stratigraphically, Component II lies in a loess deposit with a pedocomplex of weakly developed soils which overlies the sand thought to be a local correlate of the Younger Dryas. This loess deposit and associated paleosols marks the Early Holocene climatic optimum during which the Denali Complex spread through the central Alaska Range and beyond (Powers and Hoffecker 1989).

Again, like the Nenana Complex, the bulk of our knowledge about the Denali Complex is based on lithic technology (Figs. 3–5). Component II at Dry Creek contains subprismatic cores, wedge-shaped microblade cores, aberrant microblade cores, microcore preforms, miscarried microcore preforms, core tablets (microcore platform rejuvenation spalls), miscellaneous wedge-shaped core fragments, microblades, burin spalls and unretouched flakes. The tool kit (<1% of the total assemblage) is comprised of burins, core burins, bifacial tools, heavy percussion flaked implements, side scrapers (no end scrapers were found which is not untypical for the Denali Complex), flake tools, blade-like flake tools, hammerstones and anvil stones (Powers and Hoffecker 1989).

While bifacial projectile points are not commonly found in Denali Complex sites (West 1967), both Dry Creek, Component II and Ushki Lake, layers VI and Va (Dikov 1979) contain both lanceolate and bipointed

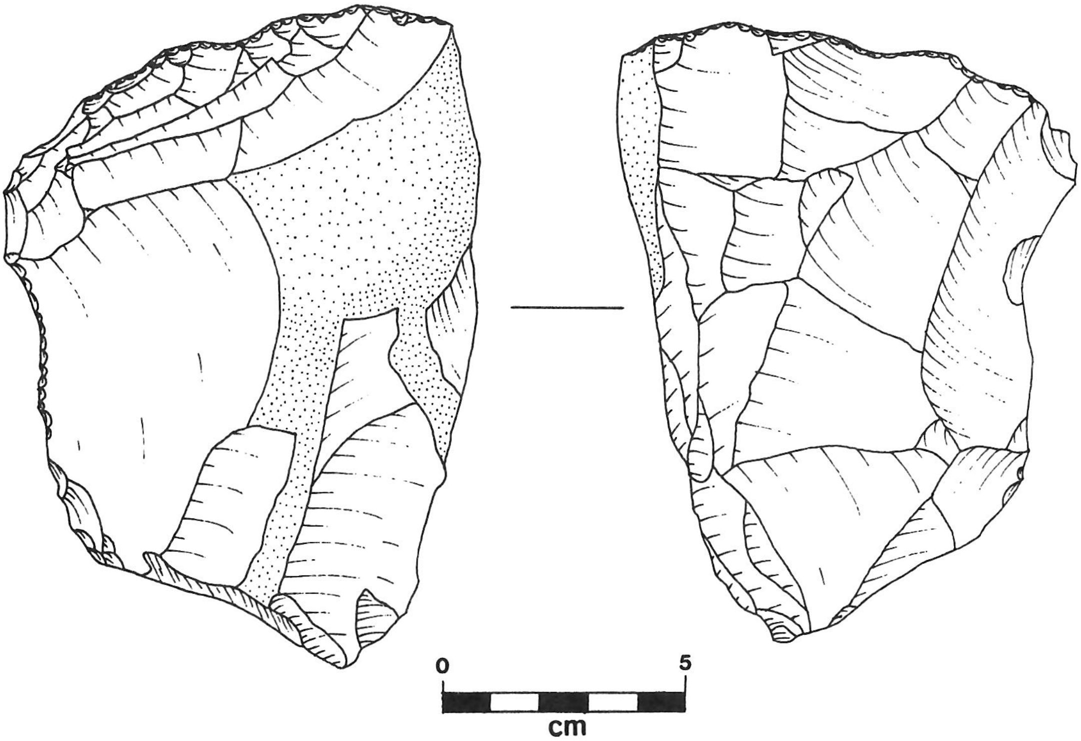

Figure 3. Denali Complex subprismatic blade core, Dry Creek

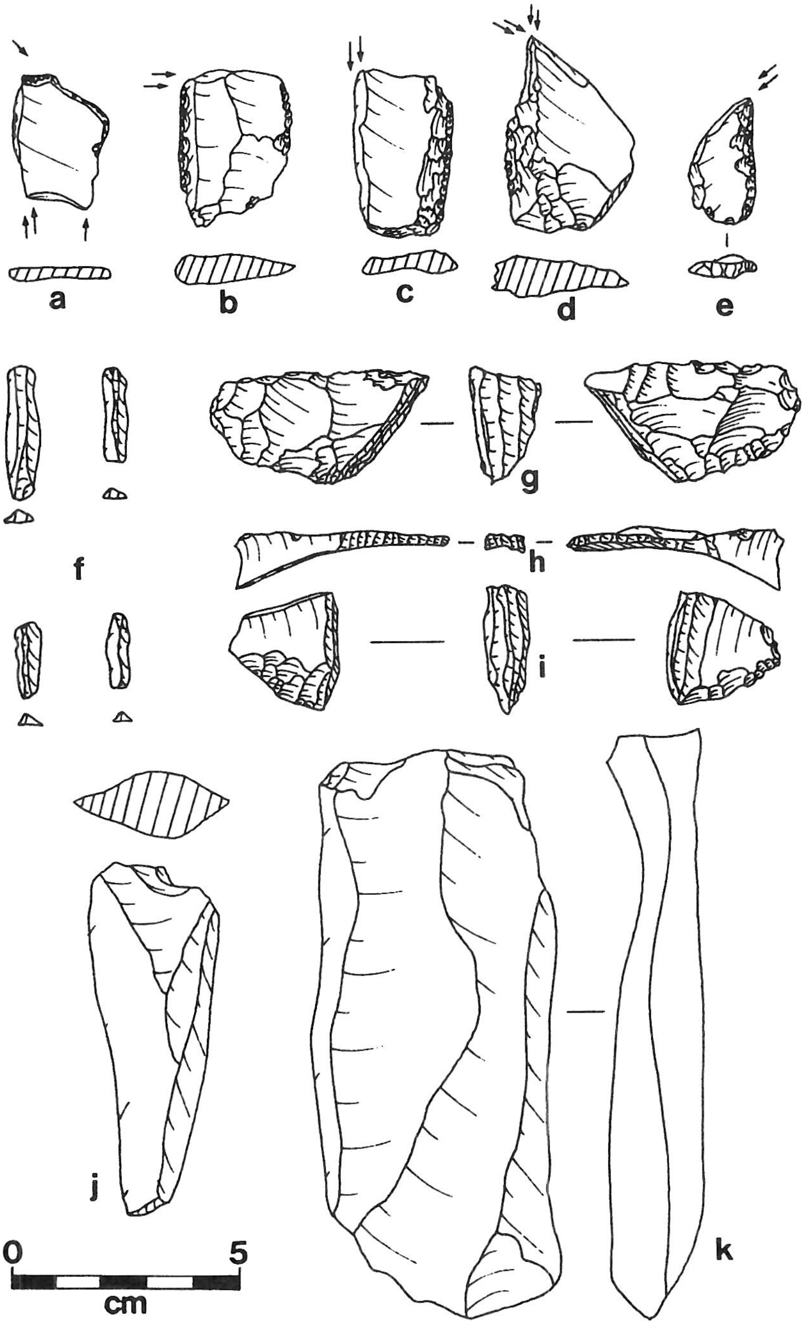

Figure 4. Denali Complex Artifacts

a.	Angle burin, Dry Creek	f.	Microblades, Little Panguingue Creek
b.	Transverse burin, Dry Creek	g.	Wedge-shaped core, Little Panguingue Creek
c.	Burin on a snap, Dry Creek	h.	Core tablet, Little Panguingue Creek
d.	Dihedral burin, Dry Creek	i.	Wedge-shaped core, Little Panguingue Creek
e.	Transverse burin on core tablet, Dry Creek	j.	Blade, Dry Creek
		k.	Blade, Dry Creek

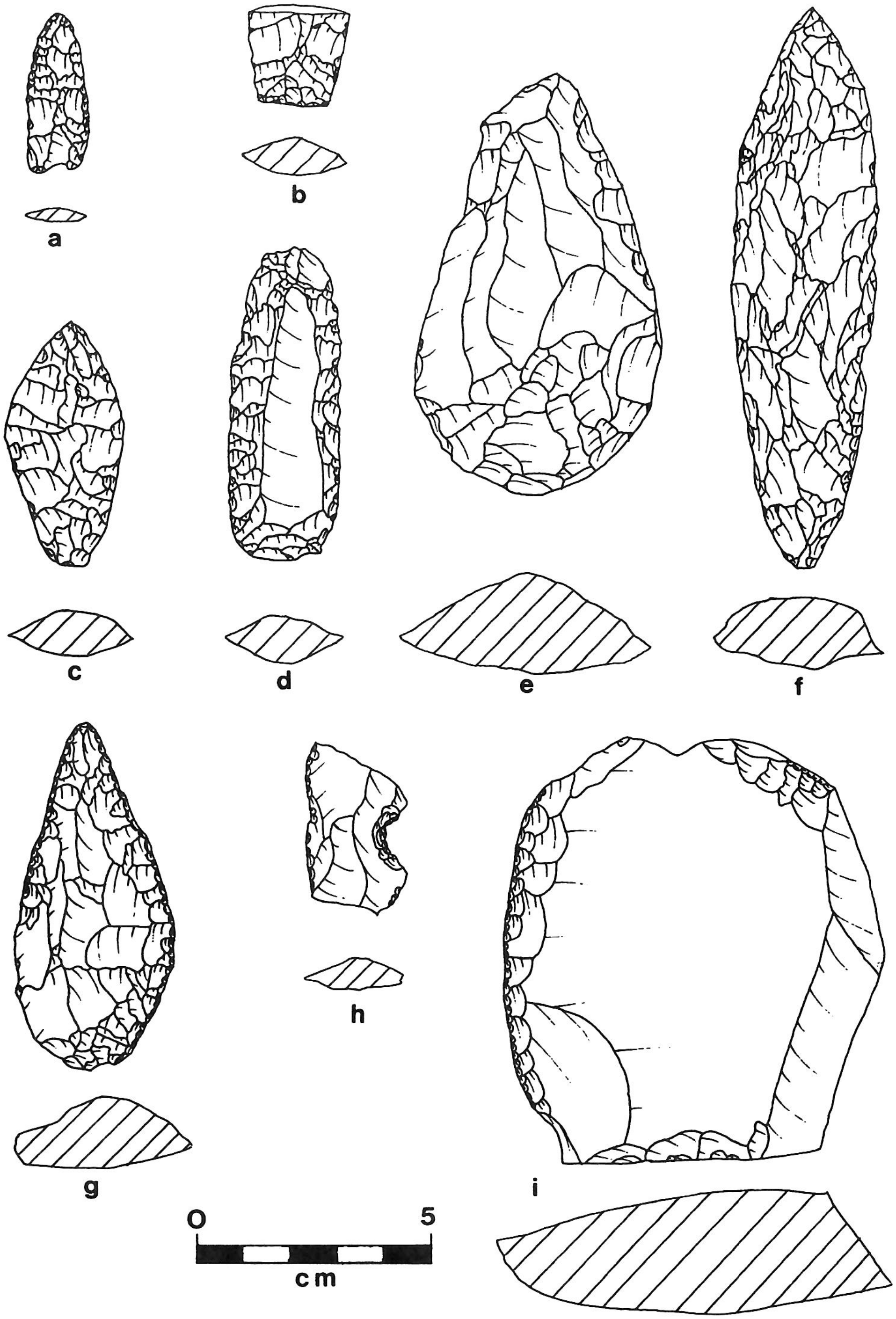

Figure 5. Denali Complex Artifacts

a. Projectile point, Dry Creek
b. Projectile point base, Dry Creek
c. Small spalulate knife, Dry Creek
d. Oblong knife, Dry Creek
e. Lanceolate biface, Dry Creek
f Elliptical knife, Dry Creek
g. Convergent side scraper, Dry Creek
h. Spokeshave, Dry Creek
i. Convex side scraper, Dry Creek

projectile points. The Dry Creek specimens are represented by bases and tips only while complete specimens are known from Ushki Lake. The morphology and metrics compare favorably with the Agate Basin type of the American Plains (Powers et al. 1983) and the bipointed specimens from both sites can be compared to Cascade points of the Pacific Northwest (Butler 1961, 1962; Newman 1966). However, while bifacial tools and, in particular, projectile points are a notable and important component of the assemblage, 92% of the worked pieces are directly related to microblade production and usage (Powers et al. 1983).

Beyond the Alaskan interior comparable assemblages have been found on the Alaska Peninsula. On the Ugashik River, the Ugashik Narrows phase dates to between 7676 ± 260 (SI-1998) and 8995 ± 295 (SI-2492) (Henn 1978). This assemblage is a good match for both the Denali Complex at Dry Creek, the later manifestation of the Denali Complex at Panguingue Creek in the Nenana Valley (7000–8600 B.P.), and the Late Ushki Upper Palaeolithic Culture of Kamchatka. The southern variant of the Paleoarctic tradition may be represented on Kodiak Island (Jordan, verbal communication, 1989), southeast Alaska (Okada et al. 1987) and in northern British Columbia (Smith 1971) although specific affinities are unclear at this time (Fladmark 1982).

At the present time only the Akmak Complex at Onion Portage in northwest Alaska (Anderson 1970; 1988) with a single date of 9570 ± 150 (K-1583) can be safely assigned to the northern variant of the Paleoarctic Tradition. It shares the general technological base of the southern variant: microblades, wedge-shaped cores burins, and bifacial tools, but the emphasis on large blades for tools, lateral burins, large blade cores, and large, non-projectile point bifacies contrasts strongly with assemblages of the southern variant. The younger Kobuk Complex is probably a local derivative of the Akmak Complex (Anderson 1988).

About 10,500 years B.P. while the Paleoarctic Tradition occupied eastern Beringia, the Sumnagin Culture was replacing the older Diuktai Culture in the Siberian interior. The new Sumnagin assemblages were based on the core and blade technique in which blades served as the preform for 90% of the tools. Also, of these tools, more than half were made on microblades. However, these blades and microblades were detached from cylindrical and pencil-shaped cores which supplanted the older wedge-shaped cores. The blades and microblades were used for insets, knives, end scrapers, notched scrapers, gravers, perforators, and lateral and angle burins. The distinctive core-drill appears for the first time in the north Asian sequence. As the Sumnagin people lived in the newly reforested Lena Basin, they made adzes, axes and large side scrapers from split cobbles and also fashioned large chopping tools, handaxe-like tools and abrading stones. The bifacial technique was used exclusively for manufacturing these large woodworking tools (Mochanov 1973). Over the next 4000 years the Sumnagin Culture exerted influences on the Early Holocene peoples of Chukotka and Kamchatka (Dikov 1979). However, there is evidence of an independent Chukotkan Mesolithic culture (Tytyl' Complex) (Kir'yak 1979, 1989). These assemblages show strong affinities with collections from Puturak Pass near the east Chukotkan coast of the Bering Sea (Kir'yak 1989). Both the Sumnagin and Chukotkan mesolithic cultures probably played some role in the formation of the Neolithic cultures of northeastern Siberia. The influence of either the Sumnagin Culture or the Chukotkan mesolithic is suspected at such sites as Anangula in the eastern Aleutians and the Koggiung Phase on the Alaska Peninsula (7500–8000 B. P.) (Dumond 1981), possibly the Gallagher Flint Station of northern Alaska (Dixon 1975) and stratigraphic unit 9 at the Jay Creek site on the Susitna River canyon (6900–7300 B. P.) (Dixon 1985). While there have been specific influences such as the use of cylindrical and pencil cores for manufacturing blades and microblades and the adoption of lateral burins on blades, for the present there is no clear evidence that the Sumnagin peoples settled any part of Alaska and in particular, the outer coastal areas.

By 5000–6000 years B.P. the Paleoarctic Tradition was being replaced over much of northern and interior Alaska by the Northern Archaic Tradition (Anderson 1968, 1988; Dixon 1985). This is a specifically American cultural tradition with roots in the North American Archaic Stage (Anderson 1968) and as such does not concern us here.

3 The Arctic Small Tool Tradition

The origins of the Arctic Small Tool Tradition appear to be straightforward. Rather than explaining the strong similarities between synchronous archaeological assemblages in both Siberia and the American Arctic as a developmental convergence arising from the Syalakh Early Neolithic Culture of the Lena Basin and the American Paleoarctic Tradition, we would argue that the Arctic Small Tool Tradition originated in northeastern Siberia as an aceramic variant of the Middle Neolithic Bel'kachi Culture (Powers and Jordan 1990). Ultimately, Arctic Small Tool origins lie even further back in the Early Neolithic and pre-Neolithic cultures of the Lena Basin (cf. Mochanov 1969b, 1973, 1977).

At about 6200 B.P., the Early Neolithic Syalakh Culture replaced the Early Holocene Sumnagin Culture in the Lena Basin (Mochanov 1969b, 1977). While this new culture probably incorporated older Sumnagin technical concepts, new ideas, possibly from the Baikal region, appear at this time: rectangular ground adzes, the bow and arrow, multi-barbed bone harpoons and egg-shaped net-impressed ceramics. The Syalakh people spread over the taiga and tundra zones of Yakutia and western Chukotka where it replaced a local Chukotkan Mesolithic (Kir'yak 1989). Some camps were established near the Arctic Ocean. Typically, Syalakh camps were established at the confluences of small and larger streams and on lake shores where the people lived in round tents with centrally positioned circular hearths (Mochanov 1969b).

The lithic technology was based on flakes, blades detached from prismatic cores and bifacial working. The tool kits were composed of: end scrapers on flakes and narrow blades, large side scrapers, partially retouched arrow points on blades, bifacial, collaterally flaked points, completely retouched leaf-shaped and stemmed arrow points (late stage), bifacially worked wedges on flakes and blades, lateral, angle and medial burins, multifaceted burins with core-like bases, leaf-shaped and asymmetric triangular bifacial knives, retouched blades, beveled blades, perforators on blades, net sinkers, flaked flat trapezoidal adzes (early stage), polished rectangular adzes (late stage). There were also bone unilaterally barbed points which sometimes have line holes, points grooved for insets, tips, needles and awls (Mochanov 1969b).

The Middle Neolithic Bel'kachi Culture appears about 5200 B.P. in the Lena Basin and replaces the older Syalakh Culture. The Bel'kachi peoples spread north and west to the Taimyr Peninsula and east through Chukotka to the Bering Strait (Mochanov 1969c) although Dikov (1979) would deal with the eastern Chukotkan neolithic assemblages differently.

The Bel'kachi Culture is very similar to the preceding Syalakh Culture particularly with respect to settlement patterns, dwellings, economy and technology. However, the independent Bel'kachi Culture is based on the appearance of new elements: cord-marked pottery (although vessel shape and rim decoration remain the same as Syalakh pottery), polished stepped adzes, flaked eared adzes, retouched grooved adzes, beaked tools, bifacial insets, willow leaf points and triangular points with an asymmetric barb in the base (Mochanov 1969c).

The Late Neolithic Ymyiakhtakh Culture appears about 4000 B.P. and replaces the Bel'kachi Culture (Mochanov 1969d; Fedoseeva 1980). It covers the same area as the Bel'kachi Culture: the upper Aldan and middle Lena to the Arctic Ocean and the Taimyr Peninsula to the Bering Strait.

The Ymyiakhtakh peoples were based on a semisedentary taiga and tundra hunting and fishing culture and lived around the mouths of tributary streams and on the shores of taiga lakes. Just as in earlier times, they lived in tepee-like structures with a centrally located pebble-lined hearth. The settlement pattern and economy are much the same as the earlier stages of the Lena Basin neolithic. There is evidence of continuity in the lithic technology: single and double platform prismatic cores, bifacial, elongate triangular arrow points with straight and notched bases, small triangular and trapezoidal end scrapers, bifacial multifaceted burins with core-like bases, elongated triangular spear points, oval knives and massive trapezoidal insets (Mochanov 1969d). There are at the same time important differences. The stone workmanship reaches an impressively high level. At the same time, tools made on blades decrease sharply from the amounts used by the Bel'kachi peoples. End scrapers on blades, blunted blades and chisels disappear and lateral and angle burins, perforators and borers become rare. Unretouched blades are used as insets but most tools are made on flakes. These lithic assemblages are associated with a waffle-net impressed or check-stamped pottery in which animal fat was used as a temper. Vessel shapes remain the same as in the earlier neolithic complexes although spherical pots and rare cup-like vessels are also encountered (Mochanov 1969d; Fedoseeva 1980).

The check-stamped pottery and the modified lithic technology are characteristic for the Ymyiakhtakh Culture. Some groups in the southern areas of Siberia were in possession of bronze at this time and it is possible that the first appearance of the new material is producing modifications in the Late Neolithic lithic inventory (Mochanov 1969d; Fedoseeva 1980). About 3300 B.P. the Bronze Age Ust'-Mil' Culture replaces the Ymyiakhtakh Culture (Fedoseeva 1980).

About 4200 B.P. the archaeological sequence at Onion Portage on the Kobuk River of northwestern Alaska is truncated by the appearance of microblade cultures which supplant the Northern Archaic Tradition (Anderson 1988; Giddings and Anderson 1986). These new cultures known as the Denbigh Flint Complex or the Arctic Small Tool Tradition spread as far south as Norton Sound and through the western and northern foothills of the Brooks Range (Anderson 1984; Giddings 1964). The Arctic Small Tool Tradition spread also through northern Alaska and adjacent Canada and became the first archaeological tradition to occupy the Canadian High Arctic, northern Labrador and Greenland (Cox 1978;

Knuth 1967; Maxwell 1985; McGhee 1979). The economy of these people appears to have been based in part on fishing in Alaska and Greenland (Anderson 1988; Knuth 1967), and the hunting of muskoxen, caribou and both bearded and ringed seals in the Eastern Arctic (Knuth 1967; McGhee 1979).

Judging from the nearly synchronous dates and similar tool assemblages in both the North American Arctic and Siberia, the Arctic Small Tool Tradition represents the rather rapid spread of a north Asian population bearing an aceramic variant of the Bel'kachi Culture from northeastern Siberia into Alaska, probably via the Bering Strait about 4200–4500 B.P. (McGhee 1976; Powers and Jordan 1990). For about 1500 years there was considerable cultural uniformity and continuity as the Arctic Small Tool Tradition occupied the arctic tundras from the Yenisei River to Greenland. The people of this tradition were in contact with prehistoric populations ranging from the ancient tundra dwellers of northwestern Siberia to the Maritime Archaic Indians of the Labrador coast of North America (Powers and Jordan 1990). To some degree the Arctic Small Tool people may have played a role in the formation of all native peoples who live on these tundras today.

4 Summary

Three major population movements which spread from northern Asia into North America have been discussed. First, the earliest settlers of Alaska, the Nenana Complex, represent a movement of ancestral Paleoindians, possibly from the northern maritime regions, but whose roots probably lie much deeper in the early Upper Palaeolithic of Central Siberia. The Nenana Complex probably shares a common ancestor with the Clovis Culture of interior North America. Secondly, the Paleoarctic peoples derived more distantly from the Diuktai Culture of interior Siberia occupy Beringia and separate into a northern variant (Akmak Complex) and southern variant (Late Ushki Upper Palaeolithic and Denali Complex). Lastly, the Arctic Small Tool Tradition, deriving from the Middle Neolithic Bel'kachi Culture spreads rapidly from the Lena Basin north to the arctic tundra of the Taimyr Peninsula and east across the tundras of the Yana, Indirirka and Kolyma rivers and Chukotka. One branch of these people penetrated Kamchatka. At the same time this tradition entered North America where it spread through the Arctic and became the first inhabitants of the Canadian High Arctic and Greenland.

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Phylogenetic Relations of Native American Languages

Merritt Ruhlen

Abstract

When European explorers stumbled upon the New World in 1492 there were probably more than a thousand distinct languages spoken by Native Americans. These numerous and diverse languages have recently been classified into three families by Joseph Greenberg: (1) Eskimo-Aleut, (2) Na-Dene, and (3) Amerind. Furthermore, each of these three families appears to be more closely related to different sets of Old World languages than to each other, thus providing linguistic evidence for three distinct migrations from the Old World to the New. Several lines of evidence indicate that the initial migration was carried out by speakers of Amerind. The second migration brought the Na-Dene to the New World; and the final migration to the Pre-Columbian Americas gave rise to the Eskimo-Aleut family.[1]

1 Introduction

For the past two centuries linguists have devoted much time and energy to the task of discovering historical relationships among languages, an enterprise generally known as Comparative-Historical linguistics. Sir William Jones's discovery of the Indo-European family in 1786 is usually cited as the beginning of comparative linguistics, but, as is well known, other language families had already been recognized long before Jones's pronouncement. Nevertheless, it is the discovery and elucidation of Indo-European by numerous scholars throughout the nineteenth century that forms the basis of our current understanding of comparative-historical linguistics. Studies of language families in other parts of the world are usually measured by how well they follow the principles of historical linguistics laid down by Indo-Europeanists.

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[1] I would like to express my appreciation to Joseph Greenberg for allowing me free access to all of his unpublished materials, which have strengthened the arguments given below in innumerable ways. I would also like to thank John Bengtson, Allan Bomhard, Harold Fleming, and Vitaly Shevoroshkin for constructive criticism of data presented in this article.

The discovery of historical relationships is based on finding words in different languages that are similar in *both* sound *and* meaning, and which may be presumed to have evolved from the same original source through the action of known processes of semantic and phonological change. Similarities in sound alone (e.g. tone, nasal vowels, the sound *r*) or in meaning alone (e.g. a word for 'pink' or 'mother's older brother') are not necessarily indicative of historical relationships (since tone and specific meanings often arise independently) and thus are usually excluded by comparative linguists. Words in different languages that are thought to derive from the same original source are called *cognates.* For example, we know that the Latin word *manu-s* 'hand' has evolved over the past 1,500 years into a variety of cognates in different Romance languages: Sardinian *manu*, Rumanian *mɨnə*, Italian *mano*, French *mæ̃*, Catalan *ma*, Spanish *mano*, Portuguese *mãw.* Even without the attested Latin word there would be a strong presumption that these words have evolved from a common source since they are phonetically very similar and virtually identical in meaning. Futhermore, a glance at the word for 'hand' in Germanic languages (e.g. English *hænd*, German *hant*, Danish *haand*) or in Balto-Slavic languages (e.g. Lithuanian *ranka*, Latvian *ruoka*, Russian *ruka*) reveals very different-looking forms.[2]

Not all words are equally valuable in classifying languages genetically. It has long been known that certain meanings are far more stable over time than others and hence more likely to reveal historical relationships. Words known to be particularly stable include personal pronouns like 'I' and 'you' (sg.); interrogative pronouns like 'who?,' 'what?,' 'where?,' and 'when?'; names for body parts such as 'hand,' 'eye,' and 'foot'; and natural phenomena like 'water,' 'fire,' and 'sun.' In 1964 Aron Dolgopolsky published a list of what he had found to be the 25 most stable meanings, which, in descending order of stability, were: I, two, thou [i.e. you singular], who?/what?, tongue, name, eye, heart, tooth, no/not, finger/toe-nail, louse, tear (drop), water, dead, nit, moon, hand, night, blood, horn, full, sun, ear, and salt. It is also true that certain sounds are more stable than others. Thus, word-initial nasal consonants such as *m-* and *n-* often remain intact for millennia, while sounds more prone to phonetic erosion, such as the voiced fricatives *β*, *ð*, and *γ*, seldom persist so long.

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[2] In earlier stages of Germanic the Romance root is also attested in forms like Old English *mund* and Old High German *munt*, thus showing that the Romance root is of Indo-European provenience and has been replaced by innovations in Germanic and Balto-Slavic.

A *language family* is a group of languages (a linguistic taxon) that are more closely related to each other than to any language outside the group. Each such family is defined by a set of lexical and grammatical cognates. Table 1 shows selected Indo-European cognates.

2 Classification of American Indian Languages

The classification of the languages of the New World has had a long and turbulent history, a summary of which is given in Ruhlen (1987: 205–27). Many American Indian language families were recognized early on (e.g. Algonquian, Iroquoian, Arawakan), in some cases even before Sir William Jones's famous lecture on Indo-European. However, as knowledge of the indigenous languages of North and South America accumulated over the succeeding two centuries, the number of supposedly independent families (i.e. families not known—or at least not *accepted*—as related to any other family) proliferated. By the mid-twentieth century the number of language families in the Old World (leaving aside New Guinea, which was still largely unknown) had been reduced to several dozen, while the number of independent families in the New World had passed 200 and was still increasing. A few scholars had fought against this current of taxonomic conservatism, most notably Edward Sapir and Alfred Kroeber, and even today it is their work that lays the foundation for the linguistic classification of much of North America. However, their voices were a small minority and were soon quelled.

On the face of it, one would not expect to find greater linguistic diversity in the New World than in the Old for the simple reason that linguistic divergence is correlated with the length of time since separation of the populations. Thus, the Romance languages, which have been going their separate way for about 1,500 years, resemble each other much more closely than do the Indo-European languages, whose differentiation began some 6,000 years ago. The general consensus of archaeologists today (though with some vigorous dissent) is that modern *Homo sapiens* was not present in the New World before 20,000 BP, and many scholars are skeptical of any dates before about 12,000 BP. When compared with dates for modern man in the Old World these dates are very recent indeed and raise the question of what forces could be responsible for the emergence of such extreme linguistic diversity in so short a time.

As it turned out, the linguistic diversity of Native American languages was greatly exaggerated by Amerindian scholars for a whole host of reasons (see Ruhlen 1987: 224–27). As early as 1956 Joseph Greenberg announced at an Anthropological Congress in Philadelphia that in his opinion the indigenous languages of the Americas could be classified into only three distinct families,

Table 1. Indo-European Cognates

Word	ANATOLIAN	TOCHARIAN	ARMENIAN	ALBANIAN	INDO-IRANIAN	GREEK	ITALIC	CELTIC	BALTIC	SLAVIC	GERMANIC
I	uk		es		ahám	egō	ego		àš	azŭ	ik
me	ammuk		es		mā́m	eme	mē	mé[22]	manè	mę	mik
thou		twe	du	ti	tuvám	su	tū	tú	tù	ty	θu
who?	kuis	kuse	ov	kush	kás	tis	quis	cía	kàs	kŭto	hwas
what?	kuit	kuse	z-i	çë	kím	ti	quid	cid	kàs	čĭto	hwa
that		te	da		tát	to			taĩ	tŭ/ta	θa
not	natta				ná		ne-	ní-	ne-	ne	ni
one				një	ékas	oi(w)os[5]	ūnus	oín	víenas	ino-[6]	ains
two	twi-	wi	erku	dy	duvā́	duo	duo	dó	dù	dŭva	twai
three	tri-	trey	erek‘	tre	tráyas	treis	trēs	trí	trỹs	trĭje	θrija
foot	pat(a)-	paiyye	otn		pā́d-	pod-	ped-		pėda[18]	pěšĭ[19]	fōtus
eye		ek	akn	sü	ákṣi-	ópsomai[10]	oculus	enech	akìs	oko	augō
tooth		keme		dhëmp	dán	odṓn	dēns		dantìs	zǫbŭ	tunθus
nose					nās-		nāsus		nosis	nosŭ	nasa[9]
heart	kart-		sirt			kardiā	cord-	cride	širdìs	srŭdĭce	hairtō
knee	kenu	keni	cunr	gju	jā́nu	gonu	genū	glún			kniu
flesh/meat		misa	mis	mish	māṅsa-		membrum[14]	mīr[15]	mésa	męso	mimz
water	watar	war		ujë	udakám	hudōr		uisce	vanduõ	voda	wato
fire	paḫḫur	puwar	hur			pūr	pir[16]				fōn
tree/wood	taru				dā́ru	doru		daur[3]		drěvo	triu[17]
month/moon		meñe	amis	muai	mā́s-	mḗn	mēnsis	mī	mėnuo	měsęcĭ	mēna
cow		keu	kov		gā́v-	bous	bōs	bó	gùovs[1]	govędo	kuo[9]
dog	śuwana-[2]	kwen-	šun		śvā́n-	kuōn	canis	con-	šuo-		hunds
wolf				ulk	vṛ́ka-	lúkos	lupus	olc[7]	vil̃kas	vlŭkŭ	wulfs
sheep			hoviw[8]		ávi-	ó(w)is	ovis	ōi	avìs	ovĭca	ouwi[9]
mouse			mukn	mī	mū́ṣ-	mûs	mūs			myšĭ	mūs[9]
father		pācer	hayr		pitár-	pater-	pater	athair			faðar
mother		mācer	mayr		mātár-	māter-	māter	máthair	mótina	mati	muotar[9]
name	lāman	ñem	anun	émën	nāman-	onoma	nōmen	ainm	emmens[13]	imę	namo
old			hin		sánas	hénos[12]	senex[21]	sen	sẽnas		sineigs
new	newas	ñuwe	nor		návas	ne(w)os	novus	nue	naũjas	novŭ	niujis
is	estsi	ste	ē	është	ásti	esti	est	is	ẽsti	jestŭ	ist
eats	etstsi		utē		átti	edei	ēst		éda	jasti	itan
carries		parän	berē	bie[4]	bhárati	pherei	fert	berid		berą[20]	bairan
die/death	merta		mah		mṛtá-	ámbrotos[11]	mortuus	marb	mir̃ti	mĭrǫ	maúrθr

Unless specified otherwise, Anatolian is represented by Hittite, Tocharian by Tocharian B, Indo-Iranian by Sanskrit, Italic by Latin, Celtic by Old Irish, Baltic by Lithuanian, Slavic by Old Church Slavonic, and Germanic by Gothic.

[1] Latvian, [2] Hieroglyphic Luwian, [3] 'oak,' [4] 'brings,' [5] 'alone,' [6] in compounds, [7] 'evil,' [8] 'shepherd,' [9] Old High German, [10] 'I will see,' [11] 'immortal,' [12] 'last year's,' [13] Old Prussian, [14] 'limb, part of the body,' [15] 'portion, morsel,' [16] Umbrian, [17] 'stick of wood,' [18] 'foot-track,' [19] 'on foot,' [20] 'bring together,' [21] 'old man,' [22] 'I.'

thus drastically reducing the supposed linguistic diversity in the New World. These three families were (1) Eskimo-Aleut, (2) Na-Dene, and (3) Amerind.[3] The distribution of these three families is shown in Map 1.

Since Eskimo-Aleut had long been recognized as a valid linguistic family and Na-Dene had been rediscovered by Sapir in the second decade of this century (after recognition by Russian scholars in the previous century), what set Greenberg's classification apart from all previous attempts was the claim that all other native American languages belonged to a single family. Greenberg did not present the evidence for his classification until 1987, having spent a good part of the previous two decades collecting as many wordlists of Native American languages as possible. Copies of these 21 hand-written notebooks may be consulted in Stanford University's Green Library. From these notebooks Greenberg extracted those forms that he believed to be cognate. Each cognate was represented in Greenberg (1987) by an etymology that listed the presumed cognate forms in a variety of American Indian languages. Greenberg proposed over 2,000 etymologies in support of the Amerind family and its eleven subgroups, including 329 etymologies supporting Amerind itself. Further study of Greenberg's book has led me to conclude that another 150 Amerind etymologies can be proposed by combining certain etymologies that Greenberg listed under different Amerind subgroups (Ruhlen 1989a). This would bring the total number of etymologies supporting Amerind to around 500. A sample of these Amerind cognates is shown in Table 2.

Note, in particular, that just as Indo-European is characterized by the pronominal pattern *m* 'I,' *t* 'thou' in all eleven subgroups, in the case of Amerind a different pronominal pattern, *n* 'I' and *m* 'thou,' characterizes all eleven Amerind subgroups. In a recent survey of pronominal patterns around the world (Ruhlen 1989b) I found that the Amerind pattern, so pervasive in the Americas, was virtually absent elsewhere in the world. That the Amerind pronominal system should have persisted so long in so many languages is perhaps less surprising than it ought to be, considering that it just happens to couple the most stable semantic concepts with the most stable sounds.

As might be expected, the internal subgrouping of the Amerind family is less well understood than the overall unity of the Amerind family itself. This is, however, a normal situation. In the case of Austronesian, which is generally thought to be about half as old as Amerind, the overall unity of the family has never been questioned, even though relatively little progress was made until recently in working out its internal structure. Greenberg (1987) proposed

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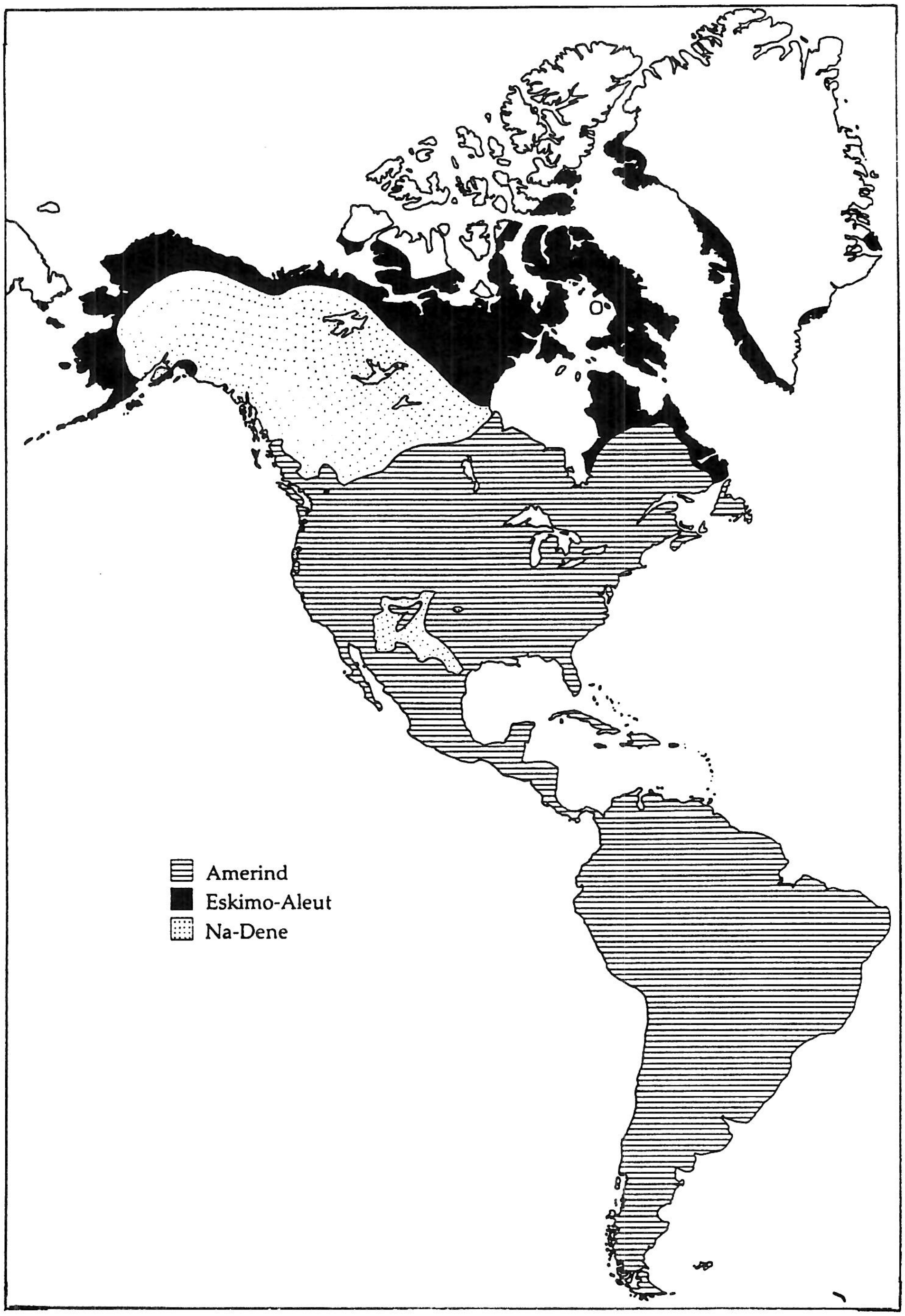
[3] The third group was not named Amerind by Greenberg until the 1970's, but its membership—all native American languages not belonging to Eskimo-Aleut or Na-Dene—was clearly delineated in the 1956 paper.



Map 1. Language Families of the Americas (from Ruhlen 1987)

Table 2. Amerind Cognates

Word	ALMOSAN-KERESIOUAN	PENUTIAN	HOKAN	CENTRAL AMERIND	CHIBCHAN-PAEZAN	ANDEAN	MACRO-TUCANOAN	EQUA-TORIAL	MACRO-CARIB	MACRO-PANOAN	MACRO-GE
I	-ən[5]	naʔ	na	nã[3]	nan	naja	en[1]	an	ana[1]	no	nu
thou	-m	ma	mai	am[4]	ma	-ma[2]	ma	ma	ama	em	ma
who?		gu	kī		kin	kunna					
where?		mani			mani			mañi			mina[8]
that	-t-[13]	t-[12]	t-[11]			ta[10]	toho		da	ta	ti[9]
not			kam	*ka							ka
two		palo-		pahn	palu	paja	paʔlin				
hand	maχwa[6]	makan	mane	*maka	man	maki	amo	*meʔeŋ		moken	mako[7]
tooth			iʔt^{s}aw	*tam				iti			itio
eye			-ītu	*te			etu	tu	etoj	toi	toi
mouth			jaʔ			ja[17]	iaʔa	jaoo		*joʔi[17]	
foot	*si	sijaʔ	saʔje							ise[14]	
leg		ṭaʔ		*ta[47]			toʔa[47]	taxu[47]	take	*taʔɨ	*tɛ
knee		ikat			-kari-[34]		*kat'	-ikketi		kat^{s}ege	
vagina		neʔēs					-eʔne[33]		iani		
girl	tuña	tūne[48]		*tun[49]				t^{x}una[19]			tontan[18]
aunt				*pan		epan				*e-pona[19]	
snake		kan				kuni			koni		kuni
ant		t^{s}okun		sikuwi		čakon					
bird	t^{s}it^{s}ipe					t^{s}ikt^{s}i[37]					
fly (n.)		čap	-komo-				kob	kããp			kap
urine		wiuš			wisi					yius[32]	
water$_1$		bai[35]		p'ãide	pui		poi[36]				beia[35]
water$_2$	*akwā[43]	okaʔ	aqa			aka[44]	okõã	uko[45]		euak	ku[46]
tree$_1$		tumaj[29]					temba[30]	nemba[31]	tapasej		
tree$_2$		ito		*tua[16]				andu	itua[31]		
thorn		onoxk						onak			
covering			šīk'o[20]		teka-ra[21]						deku[22]
good	čema		t^{s}ama	*t^{s}am	t^{s}ama		-čemači[50]	-t^{s}iama[50]			
dark	atek	tek[40]					asikẽ[41]	tekẽ[42]			*tɨk[41]
left (side)	qat^s										*keč
burn	t^{l}ɔχ[38]	łok[39]	nik		lok'						
see		t^s'elei[23]			tili	teł[24]					
say		wili					uere[27]		uʔurii[28]		
go	wa[25]	waŋ[26]	wan					wa			

Each Amerind subgroup is represented by one language (or language family), which is intended to suggest the semantic and phonetic range of the cognate in the subgroup. The name of the language cited in each example, as well as supporting cognates from other languages, may be found in *Language in the Americas*, by Joseph H. Greenberg (Stanford, 1987). [1]'we,' [2]'thy,' [3]'I, we,' [4]'thou, you,' [5]'me,' [6]'give a potlatch,' [7]'give,' [8]'who?,' [9]'he,' [10]'he, she, it, they,' [11]a stage III article, i.e. a mere marker of nominality,' [12]'his, her, its,' [13]a petrified article appearing between third-person possessive pronouns and nouns beginning with a vowel, [14]'leg,' [15]'see,' [16]'oak tree,' [17]'say,' [18]'wife,' [19]'woman,' [20]'blanket,' [21]'poncho,' [22]'woman's shirt,' [23]'look,' [24]'eye,' [25]'come,' [26]'walk,' [27]'tell,' [28]'speak,' [29]'stick, wood,' [30]'firewood,' [31]'forest,' [32]'urinate,' [33]'vulva,' [34]'shin,' [35]'rain,' [36]'to wet,' [37]'bat,' [38]'to char,' [39]'to boil,' [40]'green,' [41]'black,' [42]'excrement,' [43]'from water,' [44]'lake,' [45]'rain,' [46]'drink' (n.), [47]'foot,' [48]'daughter,' [49]'child,' [50]'beautiful.'

- AMERIND:
  - NORTHERN:
    - ALMOSAN-KERESIOUAN
    - PENUTIAN
    - HOKAN
  - CENTRAL:
    - TANOAN
    - UTO-AZTECAN
    - OTO-MANGUEAN
  - SOUTHERN:
    - CHIBCHAN-PAEZAN
    - SOUTH AMERICAN:
      - ANDEAN
      - SOUTHEAST:
        - EQUATORIAL-TUCANOAN:
          - MACRO-TUCANOAN
          - EQUATORIAL
        - GE-PANO-CARIB:
          - MACRO-CARIB
          - MACRO-PANOAN
          - MACRO-GE

Figure 1: Subgrouping of the Amerind family (after Ruhlen 1986)

certain higher level groupings for the Amerind family. In particular, in North America he combined Almosan-Keresiouan, Penutian, and Hokan in a Northern Amerind group, and in South America he suggested that Macro-Tucanoan and Equatorial formed one higher level grouping, while Macro-Carib, Macro-Panoan, and Macro-Ge formed another. My own study of the internal structure of the Amerind family has led me to conclude that there are three basic subgroups, organized as shown in Figure 1.

3 Further Connections of Eskimo-Aleut

The Eskimo—and later Eskimo-Aleut—languages have been connected over the centuries with a variety of Northern Eurasian language families. At the very first European contact with the Eskimo in 1576 Martin Frobischer noted similarities between the Eskimo language and Finno-Ugric languages. Around 1818 Rasmus Rask noted not only the close affinity of Aleut with Eskimo, but also the affinity of this Eskimo-Aleut family with the Samoyed family of languages.

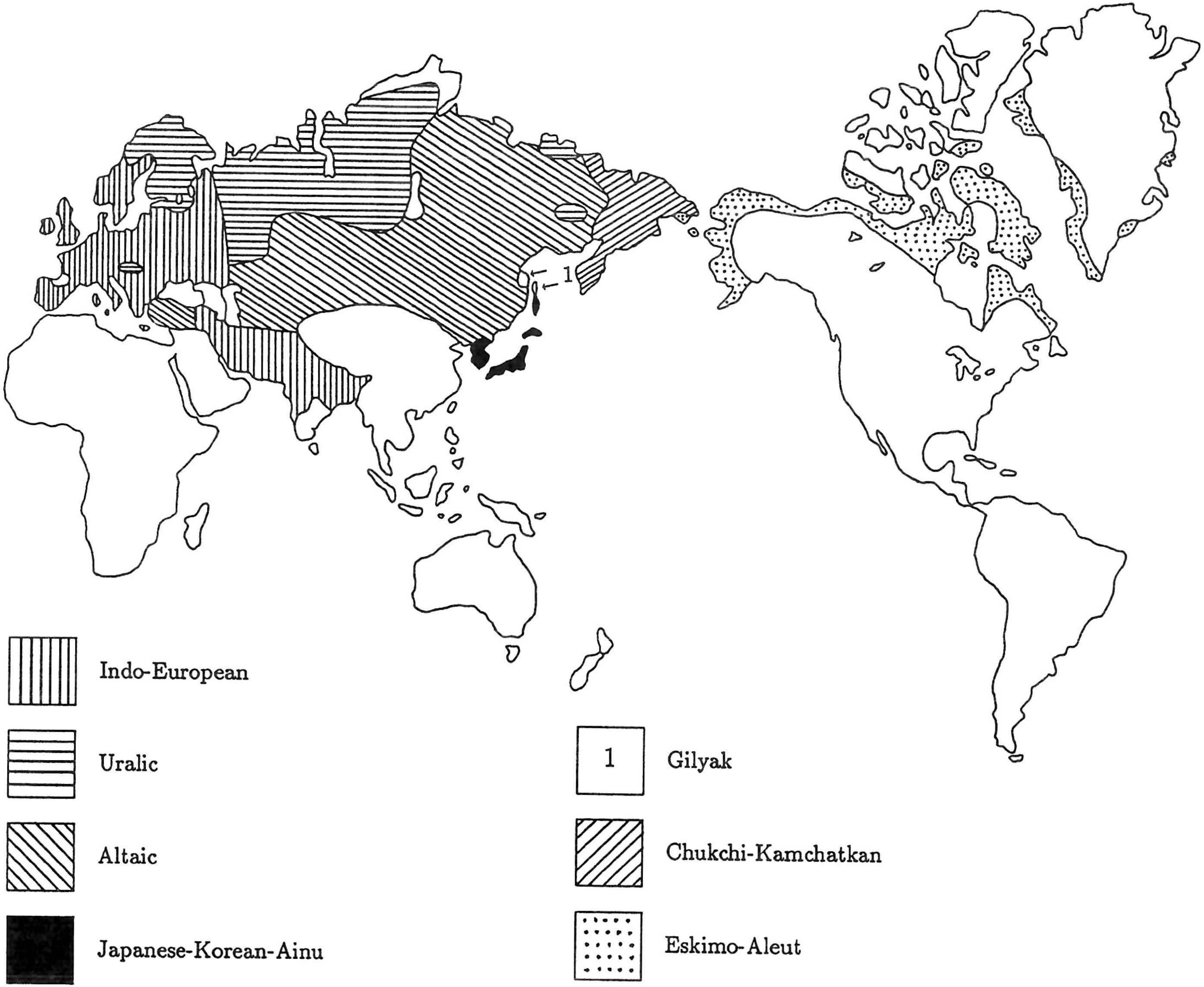
Finno-Ugric and Samoyed together constitute the Uralic family and the Eskimo-Uralic affinity has continued to have some supporters down to the present. At the same time, over the past two centuries, Eskimo-Aleut has been compared by different scholars with other language families such as Indo-European, Altaic, and Chukchi-Kamchatkan. The fact that Eskimo-Aleut seemed to share similarities now with one family, now with another was interpreted by some as meaning that all such connections were spurious. In reality, however, each of these binary proposals was correct in that Eskimo-Aleut is related to all of the above mentioned families, as well as a few others. Greenberg is currently writing a book on a language family he calls Eurasiatic, in which Eskimo-Aleut is one subgroup. Other subgroups in Eurasiatic are Indo-European, Uralic, Altaic, Korean-Japanese-Ainu, Gilyak, and Chukchi-Kamchatkan. Eskimo-Aleut thus constitutes the eastern-most extension of the Eurasiatic family, which extends from Europe through northern Eurasia into North America. The distribution of the Eurasiatic family is shown in Map 2.

Greenberg's Eurasiatic family overlaps with the Nostratic family posited by Soviet scholars (Kaiser and Shevoroshkin 1988). The Nostratic family, originally proposed by Holger Pedersen in the early twentieth century, was refined by the Soviet scholars Vladislav M. Illich-Svitych and Aron Dolgopolsky in the 1960's. In the work of Illich-Svitych Nostratic was taken to include six families: Afro-Asiatic, Kartvelian, Indo-European, Dravidian, Uralic, and Altaic. However, at one time or another other Nostraticists have proposed including all the families Greenberg includes in Eurasiatic, with the exception of Gilyak. The main difference, then, between Nostratic and Eurasiatic is that the former includes three additional families that Greenberg excludes from Eurasiatic.

Greenberg (to appear) presents over 500 lexical etymologies and 64 grammatical etymologies in support of the Eurasiatic family. A few examples of Eurasiatic cognates, taken from Greenberg's work, are shown in Table 3.

4 Further Connections of Na-Dene

In 1915 Edward Sapir published evidence for a family he named Na-Dene, which consists of three divergent languages (Haida, Tlingit, Eyak) spoken along the Pacific coast of southeastern Alaska and the widespread, but relatively homogeneous, Athabaskan family, which originally occupied most of interior Alaska, much of Western Canada, parts of the California-Oregon coastline, and a portion of the American Southwest. Eyak and Athabaskan are most closely related to each other in the Athabaskan-Eyak family. Tlingit is even more distantly related to Athabaskan than is Eyak and Haida is the most divergent member of the family, presumably having split off from Proto-Na-Dene first.



Map 2. The Eurasiatic Language Family

Table 3. Eurasiatic Cognates

Word	INDO-EUROPEAN	URALIC	TURKIC	MONGOLIAN	TUNGUS	KOREAN	JAPANESE	AINU	GILYAK	CHUKCHI-KAMCHATKAN	ESKIMO-ALEUT
I_1[32]	*mē-[1]	*-m	men[2]	mini[3]	mini[3]	-ma[4]	mi[5]		me-[6]	-m	-ma
I_2[32]	-x[33]	*-k								-k	-k
thou	*tu~te	*ti~te		*ti	-ti				ti	-t	-t[7]
pronoun base	*e-g(h)o-m[58]	en-ge-m[79]								i-ɣə-m[58]	*-m-kə-t[78]
who?	*k^{w}i~k^{w}o	ken[15]	*kim	ken	*xa-[17]	-ka[19]	ka[18]	-ka[18]	-ka[19]	k'e[16]	*kina
what?	*jo~je[24]	*jo-[24]	je-[19]	jaɣun	ja	ja[25]	i[17]~ja[25]	ja[25]	ja-	jaq[26]	
this	kū-[33]		ku[31]	-ku[81]		kɨ[80]	ko-no	ku-ri	ku[80]		
that	*to	*to	-tɨ	*te-[8]	*ta-	tjə	to[10]	to[9]		tiʔ-[8]	*ta-[8]
not	*ne	*ne				ani[23]	-na[22]	-nak[21]			na-
dual	-k'[12]	*-k	iki[13]	ikire[77]				-ki	-gi	-k[11]	-k
plural		*-t	-t[14]	*-t	-te			*-ti	-t	-ti	-t
two	*dwō-				d'ur[76]	tu		tu			
eye		nugie[55]		ńúndun	ńundun	nun	nū-ŋ[56]	nu-	ńü-n[57]	nannin[16]	
bark		*kopa	*kāp[59]			kĕpcil[61]	kapa	sik-kap[60]	xip		
feather		*tulka	tülüg[88]			thʌlʌk[88]		trax		ičelčlx[16]	t^{s}uluk[66]
star	*(s)tēr					tal[74]	teru[75]	tolibi[73]		tirkətir[73]	
fish	*(s)k^{w}alo-s	*kala			*xol-sa				q'ol	klxin[16]	iqaluk
wolf	*wl̥k^{w}o-s	loqa[27]		noqa[28]	luka[29]			horokew	łiɣ-s		
older brother		aka[48]	*āka	aqa	akā		aka[50]	aki[49]	ɨkɨn		
edge		*käćä[43]		keči[44]		*kɔt^{s}	kisí[45]	kese			
wet		*ńorV	nurĕ[31]	*nōr(u)-	*ńāru-[30]		nure[5]		ŋur		
dark	*pol-[51]	*pil'mV	boz[52]	bora[52]	balu[53]				polm[54]	pylm	
speak	*kel[68]	*kele[69]	*kǟla	kele(n)[69]					qlai[70]	kel[71]	kiliɣā[72]
think	*med-	met[82]		*mede-[83]	mede[84]	mit[85]				mitəlhən[86]	misiɣaa[87]
sleep		uni[64]		no[65]		nuŭ	nun-uŋ[50]	enunui	nax[67]		*inaɣ̣
eat	tap[46]	tēp[47]			dzəb		tabe-ru				tamaxta
arrive	*tek-[62]		teg-[14]			tah	tukú				tikippuq[63]
take	*kap-	*kap̄a-	*k^{h}apa-	qaba-	*xapki-[39]	kaph-[40]	kapu[41]		kip	ɣyvalʔyn[42]	kiputi[41]
sharpen	*(s)pik-[37]		*pǟkä		*pǟkä		pikú[38]				*piɣ-
wash	arra-[33]		arɨ[34]	arun[35]			ara-u	ruye[36]			

Adapted from *Indo-European and It's Closest Relatives: The Eurasiatic Family*, by Joseph H. Greenberg, Stanford University Press, to appear. [1]'me,' [2]Uzbek, [3]'my,' [4]expresses an emphatic wish on the part of the speaker, [5]Old Japanese, [6]'we,' [7]'thy,' [8]'this,' [9]'there,' [10]occurs marginally in expressions such as *to mo kaku mo* 'this and that,' [11]plural, [12]Armenian plural in nouns, pronouns, and verbs, [13]'two,' [14]Old Turkish, [15]Archaic Finnish, [16]Kamchadal, [17]interrogative base, [18]indefinitizer, [19]interrogative enclitic, [20]coordinating conjunction, [21]privative suffix, [22]negative suffix, [23]'not to be,' [24]relative pronoun, [25]sentence interrogative, [26]Kerek, [27]'fox,' [28]'dog,' [29]'lynx,' [30]'swamp,' [31]Chuvash, [32]first-person *m* is generally ergative or active, while first-person *k*- is absolutive, passive, or stative, where such a contrast exists, [33]Hittite, [34]'become clean,' [35]'clean,' [36]'rub gently,' [37]'point, nail,' [38]'grind,' [39]'seize by the neck,' [40]'repay,' [41]'buy,' [42]'booty,' [43]'end,' [44]Dagur, [45]'shore,' [46]Tokharian, [47]'food,' [48]Yukaghir, [49]'younger brother,' [50]Ryukyuan, [51]'gray, pale,' [52]'gray,' [53]'blind,' [54]'make blind,' [55]Yukaghir 'I have seen.' [56]Ryukyuan 'see,' [57]'see,' [58]'I,' [59]'cover,' [60]'eyelid,' [61]Middle Korean, [62]'reach,' [63]Greenlandic, [64]Finnish, [65]Dunshan, [66]'quill of a feather,' [67]'sleeping place,' [68]'call,' [69]'tongue, speech,' [70]'converse,' [71]'cry out, shout,' [72]Kuskokwim, [73]'sun,' [74]'moon,' [75]'shine,' [76]Evenki, [77]'twins,' [78]the bipersonal form of transitive verbs ("I ... thee"), [79]Hungarian 'me,' [80]'that,' [81]emphatic suffix, [82]Yukaghir 'inform,' [83]'know,' [84]'knowledge,' [85]'believe,' [86]'expert,' [87]'he perceives it,' [88]'hair.'

Soon after Sapir proposed the Na-Dene family he became aware of many striking similarities between the Na-Dene family and the Asian language family now known as Sino-Tibetan. In his correspondence with Alfred Kroeber, Sapir left no doubt that he was absolutely convinced that Na-Dene and Sino-Tibetan belonged to an even more ancient linguistic family:

> If the morphological and lexical accord which I find on every hand between Nadene and Indo-Chinese [Sino-Tibetan] is 'accidental,' then every analogy on God's earth is an accident. It is all so powerfully cumulative and integrated that when you tumble to one point a lot of others fall into line. (Golla 1984: 374)

Throughout his life Sapir kept comparative Na-Dene and Na-Dene–Sino-Tibetan notebooks, entering forms that he believed to be cognate. The notebooks were never published[4] and in fact Sapir apparently never wrote any serious exposition of the evidence that had led him to conclude that Na-Dene was more closely related to Sino-Tibetan than to other New World language families. Sapir's proposal was taken up sporadically by a few scholars (Shafer 1952, 1957, Swadesh 1952), but in the hostile climate that developed toward all long-range comparison in the United States it was generally ignored or forgotten. This was relatively easy to do inasmuch as Sapir had never published any evidence for the connection.[5]

During the past decade Sapir's proposal has been revived by Soviet scholars in the context of an even larger genetic grouping. In 1984 Sergei Starostin presented evidence for a linguistic family, which he named Sino-Caucasian, that included (North) Caucasian, Sino-Tibetan, and Yeniseian, the latter being a small family of languages in central Asia with a single surviving member, Ket. Two years later Starostin's colleague, Sergei Nikolaev, offered evidence connecting (North) Caucasian with Na-Dene and renamed the family Dene-Caucasian. In the context of Dene-Caucasian, Sapir's Na-Dene–Sino-Tibetan proposal has turned out to be but one part of an even more inclusive genetic group. If one were to criticize the Soviet studies, it would be that only certain pairs of language families have been compared within the Dene-Caucasian hypothesis. Thus, the Soviets have not followed up Sapir's original proposal even though it is considered a part of Dene-Caucasian. Nor has Yeniseian been compared with Na-Dene.

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[4] Microfilm of the notebooks may be obtained from the American Philosophical Society library in Philadelphia.

[5] It is not entirely clear why Sapir virtually ceased taxonomic work after around 1925 (he died in 1939) and never published much of the material he had spent a good part of his life collecting. From reading his letters to Alfred Kroeber between 1910–25 (Golla 1984) I have the feeling that Sapir became exasperated and fed up with the hostile and misguided attacks of such mediocre scholars as Trumen Michelson and Pliny Goddard. Sapir vigorously defended himself against Michelson's ill-founded charges (see Ruhlen 1988b), but decided not even to respond to Goddard's dismissal of Na-Dene, though he does not hide his contempt for Goddard's minimal linguistic abilities in his letters to Kroeber:

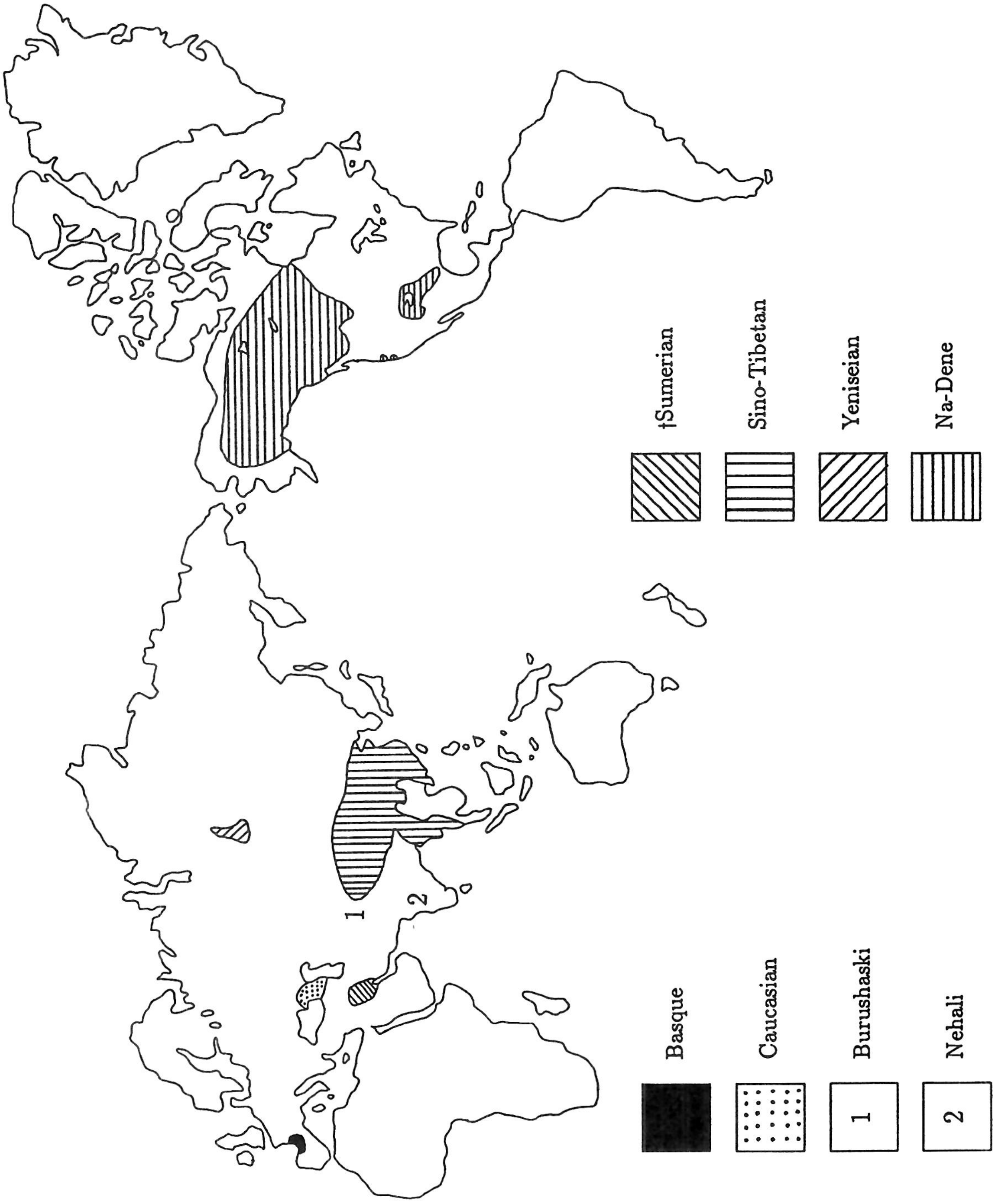
> What Goddard gives us is a miserable pittance—and wretchedly analyzed or not analyzed. Did you read his attack on my Nadene? You can have no idea of the laughable errors he commits. It is the work of an utter groundling that does not know his own material ... He is a man of no more than average linguistic ability. (Golla 1984: 377)

Sapir must have felt that if such obviously correct families as Algonquian-Ritwan and Na-Dene were ridiculed and dismissed by supposed experts, proposals for even more distant relationships—such as Na-Dene–Sino-Tibetan—would have been met with nothing short of incredulity.

Recently the Dene-Caucasian family has received additional support in Bengtson (1989) and Ruhlen (1989c,d,e). John Bengtson has taken the first multilateral look at Dene-Caucasian, attempting to compare all the families simultaneously rather than making two- and three-way comparisons, as the Soviets have so far been wont to do. Furthermore, Bengtson considers Basque, Burushaski, and the long extinct Sumerian to be members of Dene-Caucasian and includes forms from these languages in his 145 Dene-Caucasian etymologies. Early in this century the Italian linguist Alfredo Trombetti had proposed a connection between Basque and Caucasian and Bengtson adopts some of Trombetti's proposals. Burushaski and Sumerian have long been considered to have no known linguistic relatives so Bengtson's evidence that they are part of Dene-Caucasian marks an important advance. Boisson (1989) surveys all proposed connections between Sumerian and other language families. He feels Sumerian is closer to Nostratic than to Dene-Caucasian, but leaves the issue unresolved.

I have recently compared Starostin's (1982) reconstructions of Proto-Yeniseian with Na-Dene etymologies (Ruhlen 1989c), Basque, Burushaski, and Nahali, the latter a poorly known language, on the verge of extinction, still spoken in central India. The results of this comparison (Ruhlen 1989d) provide a substantial number of new Dene-Caucasian cognates, thus further strengthening the case for the family as a whole. Some of these comparisons were reported in Ruhlen (1989e).

Owing to the recent discovery of this family (or re-discovery, in light of Sapir's earlier proposal), there is not yet a consensus on precisely which language families constitute Dene-Caucasian. I believe that the following should be included: Basque, (North) Caucasian, Sumerian, Burushaski, Nahali, Sino-Tibetan, Yeniseian, and Na-Dene. The geographical distribution of these families is shown in Map 3, while Table 4 gives a selection of Dene-Caucasian cognates. These examples have been adapted from Starostin (1984), Nikolaev (1986), Bengtson (1989), and Ruhlen (1989e).



Map 3. The Dene-Caucasian Language Family

Table 4. Dene-Caucasian Cognates

Word	Basque	(North) Caucasian	Burushaski	Sumerian	Nahali	Sino-Tibetan	Yeniseian	Haida	Tlingit	Eyak	Athabaskan
I		*z^{w}o	ǯa~ǯe		ǯuo	ǯi[13]	*ʔaʒ			chuu	*šī
we	-t[15]	*it^{l}i[16]			ṭē-ku[45]			īt$^{l'}$[17]			*-ī'd
thou$_1$		*we[18]	ū-ŋ				*ʔu		weh		
thou$_2$	-k	*ɢu	gu-			*k^{w}Vj	*kV-		ɣi[19]		
thou$_3$					nā-ko[23]	*naŋ					nan[38]
who?$_1$	ze-	*sa					*ʔas-		ah-sa		
who?$_2$	no-	*nV		ana[40]	nāni	ʔan[21]	*ʔan-				
tongue	mili-[8]	*mēlt^{s}'i	-melç̌[9]	-me		*mlay					
paw	hatz	*k^{w}ač'e	qʌṣ̌[34]				*kiʔs[35]			-kaša[37]	*-keč'[36]
pupil (of eye)	-nini-	*nănV	nʌna[39]								
head		*sqa[18]	-sk-īl[44]	sağ		-sko[47]	*t^{s}ɨʔɢ-	-ǯi	si[48]	-t^{s}iʔ[48]	*-t^{s}īʔ
cheek							*χol-			l-quhł	
back	bi-zka-r	a-zk^{w}a[46]	-sqa[22]					skwai			
blood	o-dol		del[50]							deł	*deł
elbow	u-kondo	*q'^{w}ʌntV					*gid			ɢuhd	gūd[33]
vagina						*dźuk[67]		čúu			dzū́z[68]
penis		*k'əlč'V[67]	-ɣūṣ̌[69]				*gʌns-			guč	ɣīʒáʔ[68]
father		*b^{w}ab^{w}ʌjʌ	bʌba	ab.ba	aba	*bwa	*ʔob				-ba[41]
child		*kənt^{s}'V			giṭa[28]		*gʌʔt[29]	gyīt'	git'a	qēč'	ɣèʔ[30]
otter	ur-txakur						*täχʌr				
squirrel	sagu[10]	*t^{s}arku[11]	č^{h}ərge[31]			*srăiŋ	*saʔqa	-t^{s}'āk^{w}	t^{s}ʌlk	t^{s}ałk'	t^{s}olq-[12]
frog	i-gel	*q'^{w}VrV-q'V	gʊr-qut^{s}				*xiʔr-			čiałq	č'^{w}al[49]
water	i-toi[61]	*tujV[62]	thī-š[61]			*twiy		sū[63]			*tū
tree/wood						*siŋ		t^{s}an-			t^{s}ìn[43]
day(light)	e-gun	-ɢɨnV	gōn[4]	gùn[5]		*k^{w}āŋ[6]	*gəʔn[5]	kūŋ[7]	-gan[7]	x^{w}ah[7]	ǯanih[56]
star	i-zar	*-ʒ^{w}ărʕi	č^{h}ār[52]	-sar[51]		*tśar[53]				xah[55]	šah[54]
river							*ses	sī(s)[2]		šī[3]	sis-kãã[2]
ice	-tzig-[70]	t^{s}iq̄[71]	č^{h}ʌɣ-[72]	šèg̃[73]		-t^{s}ik[74]	*tiχ[75]		t'iq'	t'it^{s}'	t$^{l'}$it^{s}'[76]
cold			t^{h}ātine	ten							*t^{h}en[64]
yellow		*t^{s}ak^{w}V[24]	ṣ̌ɪk-ʌrk	sig[77]		*tsyak[42]	*täk-[78]	t^{s}ɛgɛñ[25]	sūhw[26]	t^{s}eʔq	t^{s}ək[27]
hungry	gose	*ğašī				k^{h}usśī[65]					gas[66]
spit	to	*tŭk'	thū		ṭhuk-	*(m-)tuk	*tuk		tuχ	tux	šek'[1]
sleep			gʊčh-[58]				*xus-				ɣ^{w}oš[60]
bite		*qát^{s}ɨ[59]						q'us-gat	k^{w}ač[57]	q'ət^{s}'	qət^{s}[1]

Adapted from Starostin (1984), Nikolaev (1986), Bengtson (1989), and Ruhlen (1989c,d,e). [1]Kato, [2]'ocean,' [3]'creek, stream,' [4]'dawn,' [5]'bright,' [6]Old Chinese, [7]'sun,' [8]'lick' (cf. also *mihi* 'tongue'), [9]'jaw,' [10]'rat, mouse,' [11]'marten,' [12]Carrier 'chipmunk,' [13]Newari, [14]'self,' [15]'I,' [16]'we inclusive,' [17]'us,' [18]Proto-Northwest Caucasian, [19]'you,' [20]'what?,' [21]Old Chinese 'what?,' [22]'on one's back,' [23]'you-2,' [24]'yellow, white,' [25]'urinate,' [26]'green,' [27]Tanaina, [28]'younger brother,' [29]'children,' [30]Navajo 'son,' [31]'flying squirrel,' [32]'knee,' [33]Sarsi 'knee, elbow,' [34]'arm length from elbow to fingertips,' [35]'foot,' [36]'claw,' [37]'(finger-)nail,' [38]Galice, [39]'eyeball,' [40]'what?,' [41]Carrier, seemingly isolated within Na-Dene, [42]'gold, red,' [43]Navajo, [44]'face,' [45]'we-2,' [46]Abkhaz, [47]Tibetan, [48]'neck,' [49]Hupa, [50]'oil,' [51]'new moon,' [52]'morning star,' [53]'sun, moon, star,' [54]Beaver 'sun, moon,' [55]'sun,' [56]Tanaina, [57]'swallow,' [58]'lie sleeping,' [59]Proto-East Caucasian, [60]Coquille, [61]'a drop,' [62]'spit' (n.), [63]'lake,' [64]'ice,' [65]Hruso, [66]Galice 'become hungry,' [67]'vulva,' [68]Sarsi, [69]'vagina,' [70]'frost,' [71]Avar 'sleet,' [72]'cold,' [73]'rain' (cf. also *śe* 'cold, frost'), [74]Garo 'cold,' [75]'snow,' [76]Hupa, [77]'yellow, green,' [78]'white.'

5 Further Connections of Amerind

Until recently most attempts at connecting Old World languages with New World languages had sought to show that *one specific* New World family was related to *one specific* Old World family. Although geographical propinquity does not necessarily entail an equally close genetic relationship, there can be no doubt that in general geographical distance and degree of linguistic affinity are highly correlated (see Cavalli-Sforza and Wang [1986]). For this reason it is unlikely that a language family in South America would be more closely related to some Asian family than to other language families in South and North America. In the light of Greenberg (1987) it is now clear that what must be compared is not one small family, like Algonquian or Mayan, but rather Amerind *as a whole* with some comparably aged Asian family.

After finishing his book on the Amerind family, Greenberg began work on his next book, which deals with the Eurasiatic family. One day in 1986 he remarked to me in a private conversation that Amerind and Eurasiatic shared so many similarities that he thought a special relationship between the two likely. Soon after the publication of the Amerind book in 1987 Vitaly Shevoroshkin began to point out cognates shared by Amerind and Nostratic. He did not, however, claim that they were more closely related to each other than to other languages and recently Shevoroshkin (1989c) has argued that part of Amerind (Almosan-Keresiouan) is in fact more closely related to Dene-Caucasian than to Amerind. I have recently examined the relationship of Amerind with other language families and my conclusion agrees with Greenberg's initial surmise, namely, that Amerind is more closely related to Eurasiatic than to any other language family in the world. Over a hundred etymologies supporting this relationship are proposed in Ruhlen (1989f), a selection of which is shown in Table 5.

6 Linguistic Evidence for the Peopling of the Americas

Greenberg's (1987) finding that the indigenous languages of the Americas belong to three distinct linguistic families sets an upper bound on the likely number of migrations from Asia to the New World in pre-Columbian times. If there were other migrations they have apparently left no linguistic trace. However, the three New World language families (Eskimo-Aleut, Na-Dene, Amerind) do not necessarily derive from different Asian sources. A single migration to the Americas, with subsequent differentiation into Greenberg's three families, is a logical possibility, as is two migrations, with a subsequent bifurcation in one. Without considering the three New World families in a wider context it is impossible to decide which of these three scenarios for the peopling of the Americas is the most likely: one, two, or three different migrations from Asia.

However, comparison of the three New World families with each other, and with the recognized language families of the Old World, leads to the conclusion that each New World family does in fact have a different Asian origin and thus three distinct migrations from Asia to the Americas is strongly supported by the linguistic evidence. The first migration brought Amerind speakers to a continent that had hitherto been uninhabited by modern man (or any other kind of man, for that matter). The earliest generally accepted date for the appearance of *Homo sapiens sapiens* in the New World is around 12,000 B.P., and on the basis of present evidence it seems unlikely that this date could extend back past 20,000 B.P. Both the enormous geographic distribution (see Map 1) and the great linguistic diversity point to speakers of Proto-Amerind, bearing the Clovis culture, as being the first human occupants of the Americas. The archaeological record indicates that the Amerind population expanded from North America to the tip of South America in a relatively short time, perhaps two or three millennia. If the subgrouping proposed in Figure 1 is correct, South America was populated (with perhaps a few minor exceptions) by a single immigration from North America and Southern Amerind is the synchronic reflection of this historical movement. The relative chronology of the final two migrations is less clear than the primacy of Amerind, but I am inclined to believe that the Na-Dene migration probably preceded that of the Eskimo-Aleut, again basing this conclusion on the greater geographical spread and linguistic divergence found in Na-Dene. Both the peripheral location and the relative homogeneity of the Eskimo-Aleut family (especially the Eskimo branch) indicate that this population was the last to arrive in Pre-Columbian times.[6]

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[6] On the basis of dental evidence Christy Turner has independently classified Native Americans into the same three populations that Greenberg posited on linguistic grounds (see Greenberg, Turner, and Zegura 1986). Turner believes, however, that the migration that gave rise to the Eskimo-Aleut family *preceded* that which gave rise to the Na-Dene family (Turner 1989). This possibility cannot be ruled out.

Table 5. Amerind-Eurasiatic/Nostratic Cognates

Word	Afro-Asiatic	Kartvelian	Dravidian	Indo-European	Uralic	Altaic	Korean-Japanese-Ainu	Gilyak & Chukchi-Kamchatkan	Eskimo-Aleut	Northern-Central Amerind	Southern Amerind
we inc.[1]	*m(n)	*m-	*na-m	*me-s[3]	*mä-[3]	*mä-n[4]		-m[5]	-man/s[6]	ma-k'[7]	mæ-ič[8]
we ex.	*nV	*naj	*na-[9]	*ne-/no-[3]			na[10]	nɨ-[11]		n-[12]	na-[13]
who?	*k(w)			*k^{w}o-/k^{w}i-	ki-n[14]	ke-n[15]	ka[16]	k'e[17]	*ki-na	kī[18]	kin[19]
what?	*ma/mi	*maj		*mo-[20]	*mi	*mi-	mak[21]	min[22]		minni[23]	men[24]
this$_1$	*k-	*e-g		kū-n[39]		ku[40]	ko-no[41]	ku[42]		kone[43]	ko[44]
this$_2$	*tV-	*te-/ti-	*tā	*to-/te-	*tä	*t‘ä	ta-p[21]	tiʔ-n[17]	ta-na[45]	*t-[46]	ti[47]
that	*m(w)a	*mu/ma[25]		*mo-[25]	*mū-/mō-[26]	*mu-[27]			mána[28]	mō[29]	mo[30]
he	*j-[48]	*(h)i-[49]	*ĭ/ĕ[50]	*ĥe-[48]	*i-/e-	*i-/e-	i-[21]	i-/e-[35]		ʔi[43]	i-[44]
locative	*-n	*-n	*-n	*en[31]	xu-na[33]	qa-na[32]	asa-na[34]	-n[35]	-an[36]	me-na[37]	ma-n[38]
allative	*k		*-kV		*-kV	*-kV		-ka[52]	-k[53]	-k[54]	-ek[55]
causative	*-t-[56]		*-tt-		*-tt-	*-t-	-t[41]	t-[17]	*-ti	-ʔt-[57]	
tongue		*nina			nēni[121]					*neni[120]	nene[122]
finger	*tak[163]			*deik-[90]	õtik[91]	tek[92]	tek[93]	itygin[94]	*tɨk-iq[95]	tīk[96]	tikua[97]
hand				*man-	mana[159]	mana[160]	amojn[21]	mənɣ-[52]		*man[161]	man[162]
shoulder			*tōḷ			*tālu				tala[98]	*mō-tali[99]
neck$_1$	*g(w)r[135]	*q'orq'-[135]	*kurʌ-[135]	*g^{w}erə-[136]	*kürke[135]	gürä	kālki[137]	qorqr[138]		k'oa[139]	k'ora[140]
neck$_2$					nukka[117]	nugas[118]				*nukkwi[119]	
foot			*paṭʌ[111]	*pĕd/pŏd	pod[112]	*p‘ad-ak	padak[113]	apt-[114]		pat^s[115]	*par[116]
vagina	*pwt	*put'-[106]			*putʌ[107]	*pütʌ	poto[41]		putu[108]	-bešu[109]	petu[110]
water	*ak'^{w}-			*ak^{w}a			wakka[21]			*akwa[81]	okõã[82]
fire	*ḫt'-		*otʌ-[100]	*Hĕt-		*ōti	tha[101]	t‘a[102]	*uutï-[103]	*ʔitV[104]	*ti[105]
leaf	*'bl	*bal-	*poli-[63]	*bhol-yo			p^{h}ɨl[64]	pal[17]	pilu[65]	li-bela[66]	poli[67]
day(light)				*(s)kāi[130]	*kojʌ[131]	kujaš[132]	-ka[41]	ku[35]	qau[133]	qai[134]	
dog	*k^{w}an-[74]			*k^{w}on	*küjnä[75]	qani[76]	*kańi[77]	qan[35]	qanaʁa[78]	kwan[79]	ak'uan[80]
woman	*k(w)n			*g^{w}en-		*küni[70]			aganak[71]	k^{w}ān[72]	kunja[73]
good	*t'wb			*dhabh-[83]						t^{s}'up'[84]	t^{s}up[85]
small	*k'(w)t'	*k'ut'-	*kuḍḍ-			küčük[58]	kūt-ēng[59]	kižg[17]	kituq[60]	kut'ija[61]	kutui[62]
dark	*t'(w)m			*temə-	*tumʌ	*t‘umʌ-	ətum[10]			tom[88]	etim[89]
angry				irasyati[144]			iruska[145]		irsivoq[146]		irrim[147]
bend	boq[164]			*bheug(h)-		*bükä-	he-poki-ki[2]			si-buk[68]	buka[69]
heat (v.)				*pek^w-[123]	*päkkʌ[124]	*päkü[124]	wak-[125]	pəɣpəɣ[126]	puqtla[127]	*px-[128]	pek[129]
speak				*kelɔ[148]	*kēle[149]	*k‘ǟlä-		kel[150]	kaligā[151]	*kelaw[152]	
cover	*kap-[153]				*kopa[154]	*k‘apa-	kapa[165]	xip[155]	qapuk[156]	kàpa[157]	k'aba[158]
cut	*k'ac-	*kac$_1$		*kes-	*käćʌ[141]	k‘äsä				k'ɛše[142]	k^{h}eči[143]
spit	*tufa	*t'ʌb-	*tupp-	*pt(j)eu		*t‘upy	tuba(ki)[41]			tuba[86]	tuva[87]

Adapted from Ruhlen (1989f).

[1]Inclusive *m-* is also found in the Khoisan family (cf. Kxoe *-m* 'we-2,' !Xũ *m̀* 'we inc.'), [2]Ainu 'bow down,' [3]'we,' [4]'we ex.' (oblique), [5]'let us ... ' (cf. also *mu-ri* 'we'), [6]Aleut 'we,' [7]Yokuts 'we-2 inc.,' [8]Chimu 'we,' [9]'I, we,' [10]Korean 'I,' [11]Gilyak 'we,' [12]Mixtec 'we ex., I,' [13]Mataco 'our ex.,' [14]Yukaghir, [15]Middle Mongolian, [16]Japanese indefinitizer (e.g. *nani ka* 'something' from *nani* 'what?'), [17]Kamchadal, [18]Achomawi, [19]Totoro, [20]'how, if, when?,' [21]Ainu, [22]Kamchadal 'which?,' [23]Central Sierra Miwok 'who?,' [24]Allentiac 'who?,' [25]'this, he,' [26]'other,' [27]Mongolian 'this,' [28]Kuskokwim 'this' (cf. also *imina* 'that, the one previously mentioned'), [29]Maidu 'that one,' [30]Moseten 'that, he,' [31]'in,' [32]Old Turkish 'where?,' [33]Nenets 'where?,' [34]Japanese 'in the morning,' [35]Gilyak, [36]Aleut, [37]Patwin 'where?,' [38]Matagalpa 'where?,' [39]Hittite, [40]Chuvash, [41]Japanese, [42]Gilyak 'that,' [43]Jicaque, [44]Guarani, [45]Siberian Yupik, [46]Chumash stage III article, [47]Yupua, [48]'this, he,' [49]'that,' [50]'this,' [51]Chinantec, [52]Aliutor, [53]Greenlandic locative, [54]Atsugewi, [55]Chimu 'to,' [56]reflexive, [57]Seneca, [58]Turkish, [59]Ryukyuan, [60]Kuskokwim, [61]Wappo, [62]Ingain, [63]'grow, bloom,' [64]Korean 'plant,' [65]Greenlandic, [66]Tequistlatec, [67]Wanana, [68]Chumash 'elbow,' [69]Guamaca 'knee, elbow,' [70]'wife,' [71]Alaskan Eskimo, [72]Tonkawa, [73]Kamayura, [74]Proto-Omotic, [75]'wolf,' [76]Mongolian 'a wild masterless dog,' [77]Korean (modern *kǟ*), [78]Sirenik 'wolf,' [79]Yurumangui, [80]Chilanga 'deer,' [81]Proto-Central Algonquian 'from water,' [82]Auake,' [83]'to be suitable, fitting,' [84]Yana, [85]Eten, [86]Patwin, [87]Witoto, [88]Nootka, [89]Urupa 'night,' [90]'point' (v.), [91]Zyrian 'one,' [92]Turkish 'only,' [93]Ainu 'hand,' [94]Kamchadal 'paw,' [95]'index finger,' [96]Karok, [97]Kukura, [98]Achomawi, [99]Proto-Carib, [100]'kindle,' [101]Korean 'burn,' [102]Gilyak 'burn,' [103]'burn,' [104]Proto-Californian Penutian 'roast,' [105]Proto-Tacanan, [106]'hole,' [107]'anus,' [108]Greenlandic 'hole,' [109]Tequistlatec, [110]Guahibo, [111]'footsteps,' [112]Zyrian, [113]Korean 'sole,' [114]Koryak 'kick,' [115]Lutuami, [116]Proto-Ge, [117]Selkup 'nape of the neck,' [118]Khalkha 'spinal cord,' [119]Proto-Muskogean, [120]Proto-Uto-Aztecan, [121]Kamassian, [122]Tucano, [123]'cook,' [124]'hot,' [125]Japanese 'boil' (< **bak*), [126]Koryak 'boil,' [127]Kuskokwim 'heat,' [128]Proto-North Wakashan 'warm' (v.), [129]Botocudo 'burn,' [130]'clear, light,' [131]'dawn,' [132]Yakut 'dawn,' [133]Inuit, [134]Siuslaw 'dawn' (v.), [135]'throat,' [136]'swallow,' [137]Korean 'mane,' [138]Gilyak 'throat,' [139]Isleta, [140]Uro, [141]'knife,' [142]Wappo, [143]Fulnio 'divide,' [144]Sanskrit 'becomes angry,' [145]Ainu 'become angry,' [146]Greenlandic 'is afraid,' [147]Millcayac, [148]'shout,' [149]'tongue,' [150]Kamchadal 'shout,' [151]Kuskokwim 'calls,' [152]Proto-Algonquian, [153]'cover, close,' [154]'bark,' [155]Gilyak 'birch bark,' [156]Greenlandic 'froth, scum,' [157]Haisla 'covered with frost,' [158]Atacama 'hide,' [159]Yurok Samoyed 'finger,' [160]Tungus 'paw,' [161]Proto-Chinantec, [162]Ayoman, [163]'one,' [164]Dime 'knee,' [165]Japanese 'bark.'

Linguistic evidence of three distinct migrations is given in Tables 3, 4, and 5, in which each New World family is shown to be more closely related to a different set of Old World language families than to each other. Specifically, the Amerind family is most closely related to Eurasiatic[7]; Na-Dene is the eastern-most extension of Dene-Caucasian; and Eskimo-Aleut is the eastern-most extension of Eurasiatic.

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[7] Soviet scholars have proposed that Amerind is most closely related to the language families of Southeast Asia commonly known as Austric (Austroasiatic, Miao-Yao, Daic [Tai-Kadai], Austronesian). While I do not doubt that Amerind is related to Austric, it seems to me on the basis of available evidence that the relationship between Amerind and Eurasiatic is much closer than that between Amerind and Austric. It is worth mentioning that in a recent study of human genetics on a world-wide scale, Cavalli-Sforza et al. (1988) found that New World populations belong to three distinct clusters that correspond almost exactly with Greenberg's tri-partite classification. Furthermore, the biological evidence suggests that Amerind is most closely associated with North Eurasian populations speaking Eurasiatic/Nostratic languages.

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